Learning about Comparative Advantage in Entrepreneurship: Evidence from Thailand

Anant Nyshadham

University of Southern California

October 5, 2012

Motivation

- Non-agricultural household enterprise is an important part of economic livelihood in developing countries
  - Entrepreneurship proposed as important driver of growth *(e.g. Foster & Rosenzweig (2004))*
  - Policy and public resources focused on encouraging entrepreneurship and improving business prospects *(microfinance, training, consulting, etc.)*
  - Townsend Thai Data: over 40% of households own a non-agricultural enterprise each year

Motivation

- Non-agricultural household enterprise is an important part of economic livelihood in developing countries
  - Entrepreneurship proposed as important driver of growth *(e.g. Foster & Rosenzweig (2004))*
  - Policy and public resources focused on encouraging entrepreneurship and improving business prospects *(microfinance, training, consulting, etc.)*
  - Townsend Thai Data: over 40% of households own a non-agricultural enterprise each year

Motivation

- Non-agricultural household enterprise is an important part of economic livelihood in developing countries
  - Entrepreneurship proposed as important driver of growth *(e.g. Foster & Rosenzweig (2004))*
  - Policy and public resources focused on encouraging entrepreneurship and improving business prospects *(microfinance, training, consulting, etc.)*
  - Townsend Thai Data: over 40% of households own a non-agricultural enterprise each year

Motivation

- Non-agricultural household enterprise is an important part of economic livelihood in developing countries
  - Entrepreneurship proposed as important driver of growth *(e.g. Foster & Rosenzweig (2004))*
  - Policy and public resources focused on encouraging entrepreneurship and improving business prospects *(microfinance, training, consulting, etc.)*
  - Townsend Thai Data: over 40% of households own a non-agricultural enterprise each year

Motivation

- Few household businesses grow to represent primary income source or employ non-household members
  - roughly 1/4 of enterprise households generate at least 50% of household income from business
  - roughly 11% of enterprise households had paid employees
- Why do a fraction succeed and grow? Why do seemingly unsuccessful enterprises persist?

Motivation

- Few household businesses grow to represent primary income source or employ non-household members
  - roughly 1/4 of enterprise households generate at least 50% of household income from business
  - roughly 11% of enterprise households had paid employees
- Why do a fraction succeed and grow? Why do seemingly unsuccessful enterprises persist?
  - SPOILER ALERT: Some households rationally invest in enterprises with low returns in the long run, but high returns intermittently as they figure this out.

Motivation

- Few household businesses grow to represent primary income source or employ non-household members
  - roughly 1/4 of enterprise households generate at least 50% of household income from business
  - roughly 11% of enterprise households had paid employees
- Why do a fraction succeed and grow? Why do seemingly unsuccessful enterprises persist?
  - SPOILER ALERT: Some households relatively bad at enterprise; won't do it in the long-run, but participate intermittently as they figure this out

Motivation

- Few household businesses grow to represent primary income source or employ non-household members
  - roughly 1/4 of enterprise households generate at least 50% of household income from business
  - roughly 11% of enterprise households had paid employees
- Why do a fraction succeed and grow? Why do seemingly unsuccessful enterprises persist?
  - SPOILER ALERT: Some households relatively bad at enterprise; won't do it in the long-run, but participate intermittently as they figure this out

Motivation

- Few household businesses grow to represent primary income source or employ non-household members
  - roughly 1/4 of enterprise households generate at least 50% of household income from business
  - roughly 11% of enterprise households had paid employees
- Why do a fraction succeed and grow? Why do seemingly unsuccessful enterprises persist?
  - SPOILER ALERT: Some households relatively bad at enterprise; won't do it in the long-run, but participate intermittently as they figure this out

Research Questions

- What are the returns to entrepreneurship?
- Does everyone face the same returns?
- Do households know their returns?
- Which households sort in/out of entrepreneurship?
- What factors predominantly drive this sorting?

Research Questions

- What are the returns to entrepreneurship?
- Does everyone face the same returns?
- Do households know their returns?
- Which households sort in/out of entrepreneurship?
- What factors predominantly drive this sorting?

Research Questions

- What are the returns to entrepreneurship?
- Does everyone face the same returns?
- Do households know their returns?
- Which households sort in/out of entrepreneurship?
- What factors predominantly drive this sorting?

Research Questions

- What are the returns to entrepreneurship?
- Does everyone face the same returns?
- Do households know their returns?
- Which households sort in/out of entrepreneurship?
- What factors predominantly drive this sorting?

Research Questions

- What are the returns to entrepreneurship?
- Does everyone face the same returns?
- Do households know their returns?
- Which households sort in/out of entrepreneurship?
- What factors predominantly drive this sorting?

Research Questions

- Can think of entrepreneurship decision as being driven primarily by 2 factors:
  - gross return (ability/productivity)
  - cost (access to financial resources)
- Are non-entrants constrained more by cost or ability (comparative advantage)?

Research Questions

- Can think of entrepreneurship decision as being driven primarily by 2 factors:
  - gross return (ability/productivity)
  - cost (access to financial resources)
- Are non-entrants constrained more by cost or ability (comparative advantage)?

Research Questions

- Can think of entrepreneurship decision as being driven primarily by 2 factors:
  - gross return (ability/productivity)
  - cost (access to financial resources)
- Are non-entrants constrained more by cost or ability (comparative advantage)?

Previous Studies: Costs (e.g. Credit, Risk, Formality)

- Theoretical:
  - credit constraints keep (high return) households from starting businesses *(e.g. Banerjee & Newman (1993, 1994); Paulson, Townsend, & Karaivanov (2006))*
  - maybe not so simple *(Buera (2009); Buera, Kaboski, & Shin (2011); Midgrigan & Xu (2011))*
- Empirical/Experimental:
  - Mixed results on role of finance, insurance, regulatory infrastructure *(Partial review: McKenzie (2010))*
  - No effects of loan offers on business formation in Mexico (Crepon, Devoto, Duflo & Parienté (2011))
  - Large effects of new MFI branch on entry in India (Banerjee, Duflo, Glennerster & Kinnan (2010))

Previous Studies: Costs (e.g. Credit, Risk, Formality)

- Theoretical:
  - credit constraints keep (high return) households from starting businesses *(e.g. Banerjee & Newman (1993, 1994); Paulson, Townsend, & Karaivanov (2006))*
  - maybe not so simple *(Buera (2009); Buera, Kaboski, & Shin (2011); Midgrigan & Xu (2011))*
- Empirical/Experimental:
  - Mixed results on role of finance, insurance, regulatory infrastructure *(Partial review: McKenzie (2010))*
  - No effects of loan offers on business starts in Morocco *(Crepon, Devoto, Duflo & Pariente (2011))*
  - Large effects of new MFI branch on entry in India *(Banerjee, Duflo, Glennerster & Kinnan (2010))*

Previous Studies: Costs (e.g. Credit, Risk, Formality)

- Theoretical:
  - credit constraints keep (high return) households from starting businesses *(e.g. Banerjee & Newman (1993, 1994); Paulson, Townsend, & Karaivanov (2006))*
  - maybe not so simple *(Buera (2009); Buera, Kaboski, & Shin (2011); Midgrigan & Xu (2011))*
- Empirical/Experimental:
  - Mixed results on role of finance, insurance, regulatory infrastructure *(Partial review: McKenzie (2010))*
  - No effects of loan offers on business starts in Morocco *(Crepon, Devoto, Duflo & Pariente (2011))*
  - Large effects of new MFI branch on entry in India *(Banerjee, Duflo, Glennerster & Kinnan (2010))*

Previous Studies: Costs (e.g. Credit, Risk, Formality)

- Theoretical:
  - credit constraints keep (high return) households from starting businesses *(e.g. Banerjee & Newman (1993, 1994); Paulson, Townsend, & Karaivanov (2006))*
  - maybe not so simple *(Buera (2009); Buera, Kaboski, & Shin (2011); Midgrigan & Xu (2011))*
- Empirical/Experimental:
  - Mixed results on role of finance, insurance, regulatory infrastructure *(Partial review: McKenzie (2010))*
  - No effects of loan offers on business starts in Morocco *(Crepon, Devoto, Duflo & Pariente (2011))*
  - Large effects of new MFI branch on entry in India *(Banerjee, Duflo, Glennerster & Kinnan (2010))*

Previous Studies: Costs (e.g. Credit, Risk, Formality)

- Theoretical:
  - credit constraints keep (high return) households from starting businesses *(e.g. Banerjee & Newman (1993, 1994); Paulson, Townsend, & Karaivanov (2006))*
  - maybe not so simple *(Buera (2009); Buera, Kaboski, & Shin (2011); Midgrigan & Xu (2011))*
- Empirical/Experimental:
  - Mixed results on role of finance, insurance, regulatory infrastructure *(Partial review: McKenzie (2010))*
  - No effects of loan offers on business starts in Morocco *(Crepon, Devoto, Duflo & Pariente (2011))*
  - Large effects of new MFI branch on entry in India *(Banerjee, Duflo, Glennerster & Kinnan (2010))*

Previous Studies: Ability or Skills

- This study contributes to recent literature on role of ability/business skills in
  - entry/exit decisions *(e.g. Bruhn & Zia (2011); de Mel, McKenzie, and Woodruff (2012))*
  - performance and growth of existing enterprises *(e.g. Bloom et al (2011); Karlan & Valdivia (2011); Bruhn et al (2011); Drexler et al (2011); de Mel et al(2012))*
- Review reveals issues *(McKenzie & Woodruff (2012))*
  - attrition, selective survival, and start-up in sample → high frequency switching of enterprise status
  - low adoption and small effects on business practices consistent with unprofitably close to zero returns to capital

Previous Studies: Ability or Skills

- This study contributes to recent literature on role of ability/business skills in
  - entry/exit decisions *(e.g. Bruhn & Zia (2011); de Mel, McKenzie, and Woodruff (2012))*
  - performance and growth of existing enterprises *(e.g. Bloom et al (2011); Karlan & Valdivia (2011); Bruhn et al (2011); Drexler et al (2011); de Mel et al(2012))*
- Review reveals issues *(McKenzie & Woodruff (2012))*
  - attrition, selective survival, and start-up in sample → high frequency switching of enterprise status
  - low adoption and small effects on implementation → consistent with uncertainty about future enterprise

Previous Studies: Ability or Skills

- This study contributes to recent literature on role of ability/business skills in
  - entry/exit decisions *(e.g. Bruhn & Zia (2011); de Mel, McKenzie, and Woodruff (2012))*
  - performance and growth of existing enterprises *(e.g. Bloom et al (2011); Karlan & Valdivia (2011); Bruhn et al (2011); Drexler et al (2011); de Mel et al(2012))*
- Review reveals issues *(McKenzie & Woodruff (2012))*
  - attrition, selective survival, and start-up in sample $\rightarrow$ high frequency switching of enterprise status
  - low adoption and small effects on implementation $\rightarrow$ consistent with uncertainty about future enterprise

Previous Studies: Ability or Skills

- This study contributes to recent literature on role of ability/business skills in
  - entry/exit decisions *(e.g. Bruhn & Zia (2011); de Mel, McKenzie, and Woodruff (2012))*
  - performance and growth of existing enterprises *(e.g. Bloom et al (2011); Karlan & Valdivia (2011); Bruhn et al (2011); Drexler et al (2011); de Mel et al(2012))*
- Review reveals issues *(McKenzie & Woodruff (2012))*
  - attrition, selective survival, and start-up in sample $\rightarrow$ high frequency switching of enterprise status
  - low adoption and small effects on implementation $\rightarrow$ consistent with uncertainty about future enterprise

Model Hypothesis

- Households sort into the entrepreneurial sector on expected comparative advantage
  - expectations of relative ability in business over agriculture drive choice more than do financial constraints in this setting
- Over time, households
  - learn about their comparative advantage
  - switch in and out of the entrepreneurial sector
  - converge to the optimal sector choice

Model Hypothesis

- Households sort into the entrepreneurial sector on expected comparative advantage
  - expectations of relative ability in business over agriculture drive choice more than do financial constraints in this setting
- Over time, households
  - learn about their comparative advantage
  - switch in and out of the entrepreneurial sector
  - converge to the optimal sector choice

Model Hypothesis

- Households sort into the entrepreneurial sector on expected comparative advantage
  - expectations of relative ability in business over agriculture drive choice more than do financial constraints in this setting
- Over time, households
  - learn about their comparative advantage
  - switch in and out of the entrepreneurial sector
  - converge to the optimal sector choice

Model Hypothesis

- Households sort into the entrepreneurial sector on expected comparative advantage
  - expectations of relative ability in business over agriculture drive choice more than do financial constraints in this setting
- Over time, households
  - learn about their comparative advantage
  - switch in and out of the entrepreneurial sector
  - converge to the optimal sector choice

Model Hypothesis

- Households sort into the entrepreneurial sector on expected comparative advantage
  - expectations of relative ability in business over agriculture drive choice more than do financial constraints in this setting
- Over time, households
  - learn about their comparative advantage
  - switch in and out of the entrepreneurial sector
  - converge to the optimal sector choice

Descriptive Evidence

- This study uses data from the Townsend Thai Project over last half decade
- Evaluations of large microfinance initiative from earlier in the decade find
  - large investment responses among some households *(Kaboski & Townsend (2011))*
  - no effects on entrepreneurial entry *(Kaboski & Townsend (2012))*
- Descriptive evidence from Thai data does **not** support important role for credit constraints in entry decision

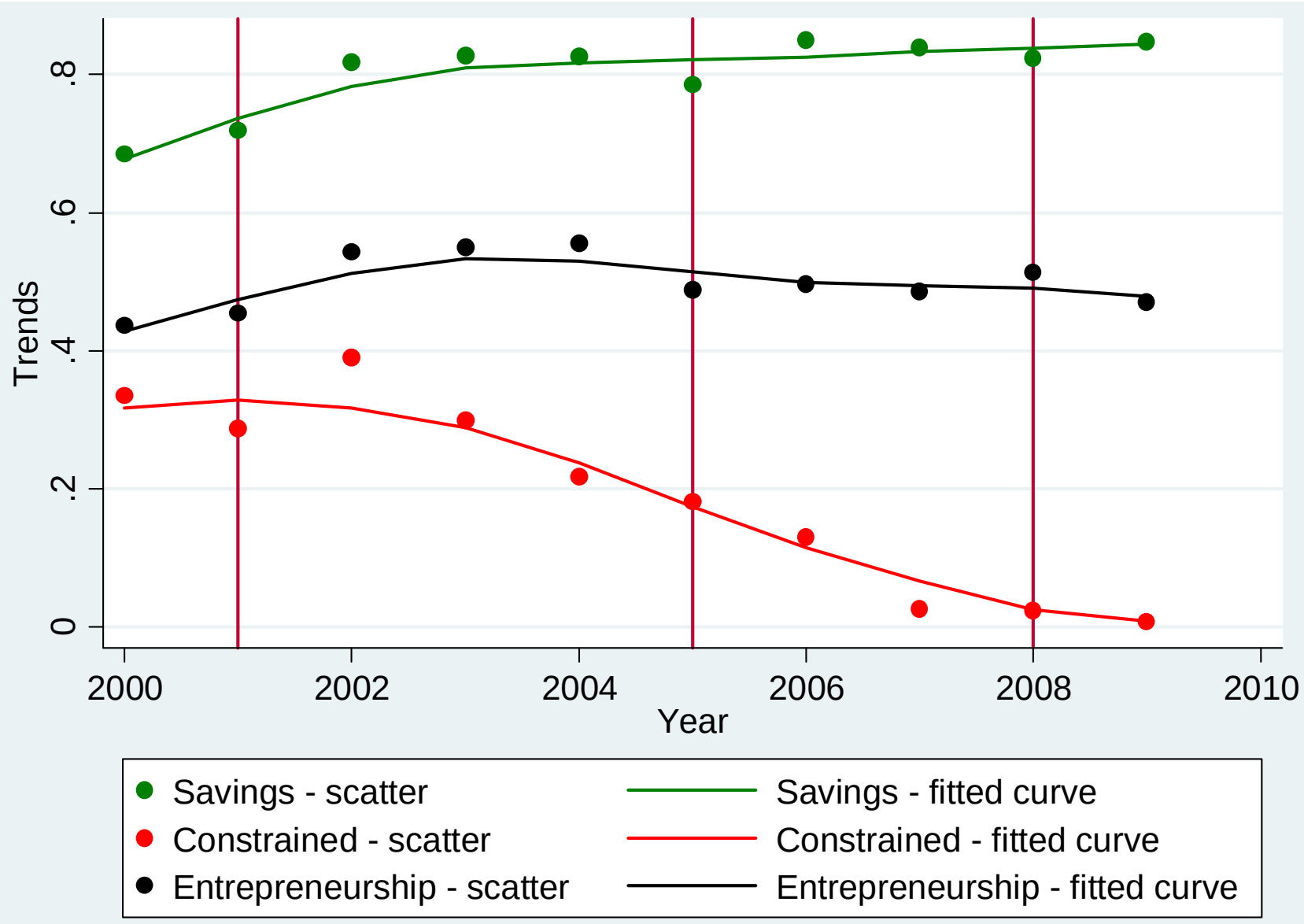
Descriptive Evidence

- This study uses data from the Townsend Thai Project over last half decade
- Evaluations of large microfinance initiative from earlier in the decade find
  - large investment responses among some households *(Kaboski & Townsend (2011))*
  - no effects on entrepreneurial entry *(Kaboski & Townsend (2012))*
- Descriptive evidence from Thai data does **not** support important role for credit constraints in entry decision

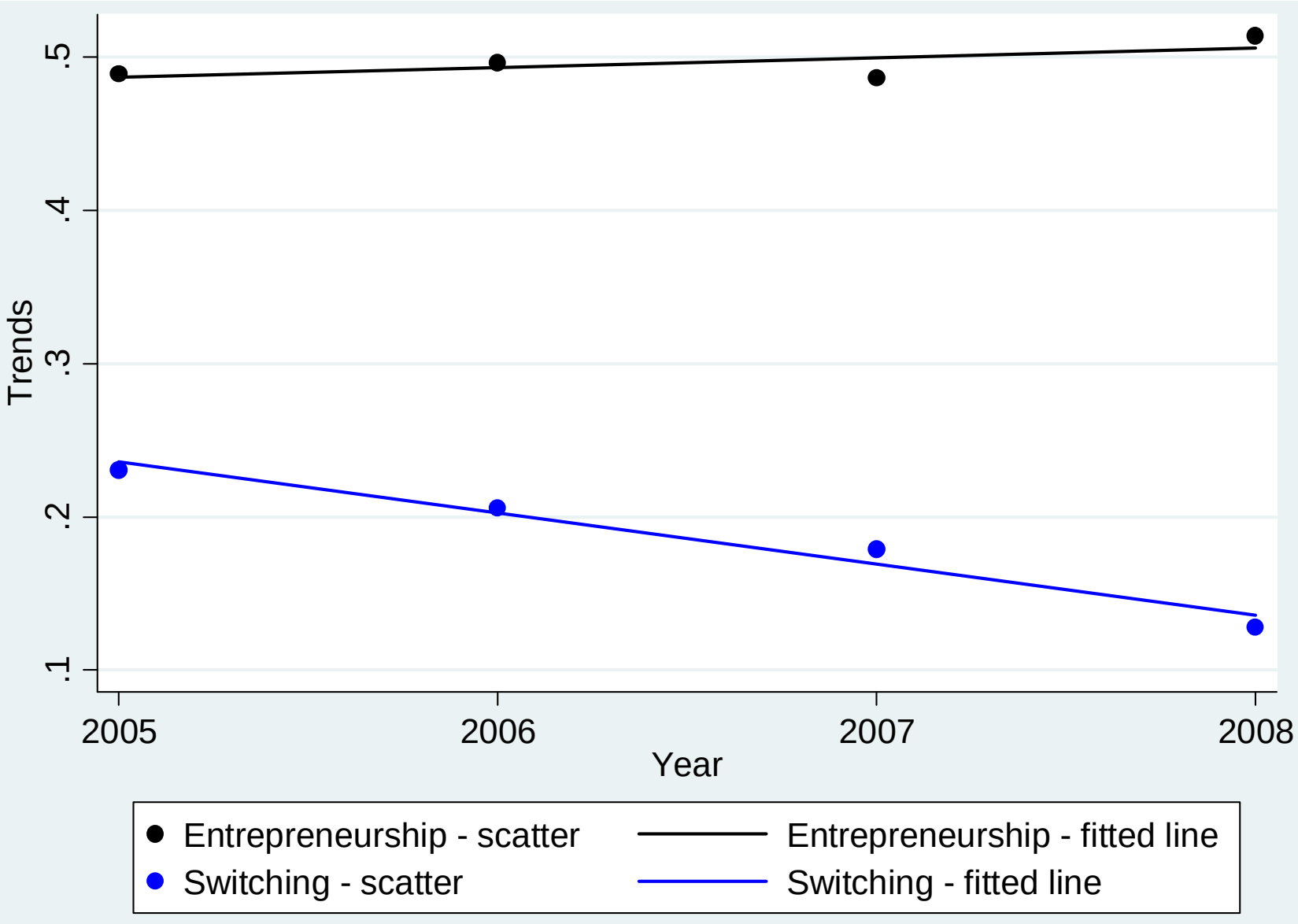
Descriptive Evidence

- This study uses data from the Townsend Thai Project over last half decade
- Evaluations of large microfinance initiative from earlier in the decade find
  - large investment responses among some households *(Kaboski & Townsend (2011))*
  - no effects on entrepreneurial entry *(Kaboski & Townsend (2012))*
- Descriptive evidence from Thai data does **not** support important role for credit constraints in entry decision

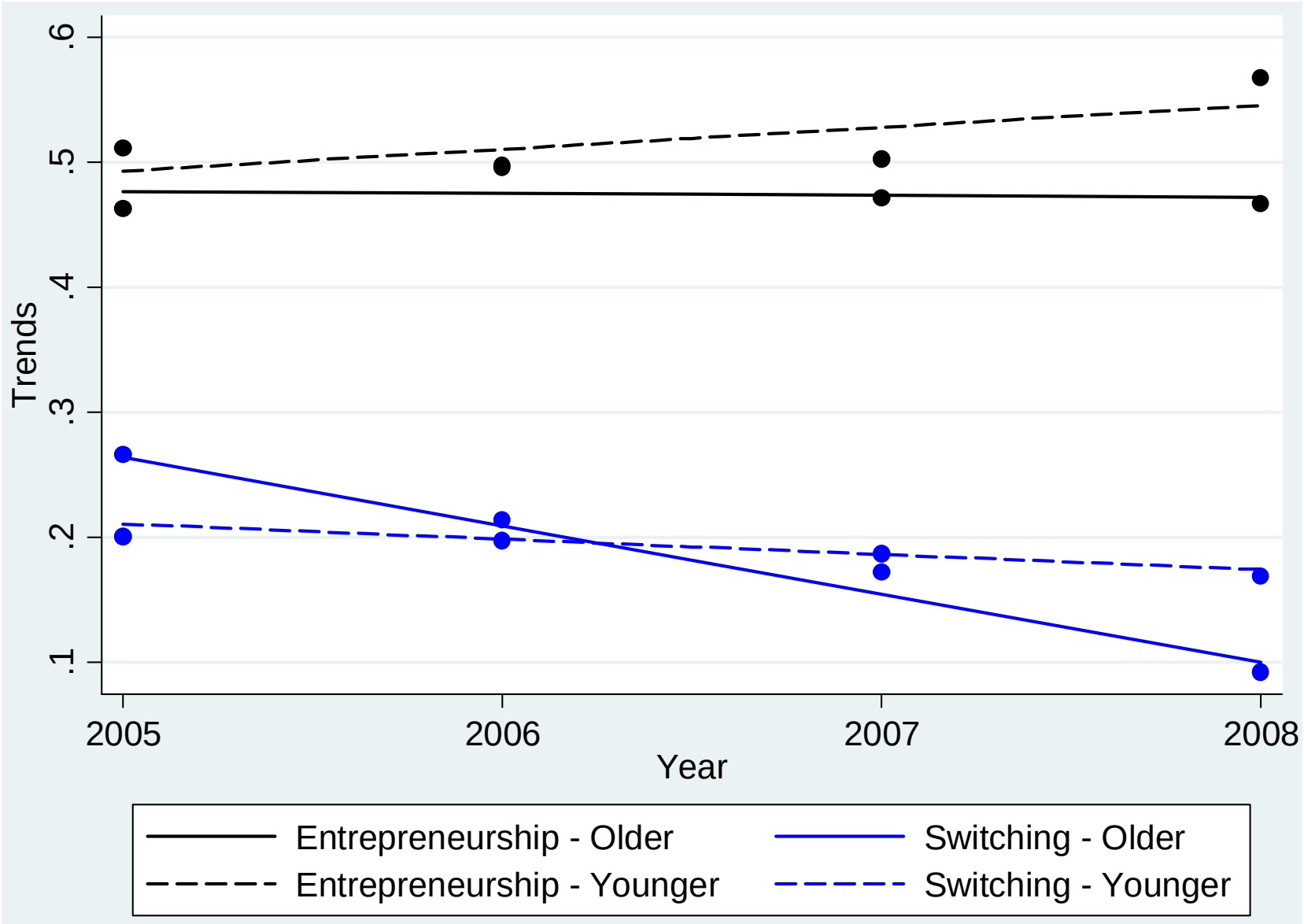
Descriptive Evidence: Trends



Descriptive Evidence: Switching



Descriptive Evidence: Switching by Age of HH



Preview of Results

- Large positive average returns to entrepreneurship
- Sorting on heterogeneous returns (marginal return is low)
  - households with *high* earnings in default sector have *low* returns to entrepreneurship
- Evidence of dynamics from learning about return rather than saving out of financial constraints
  - households switch into enterprise after low productivity realization in agriculture
- Validate model predictions and structural estimates using data on expected incomes by enterprise history

Preview of Results

- Large positive average returns to entrepreneurship
- Sorting on heterogeneous returns (marginal return is low)
  - households with *high* earnings in default sector have *low* returns to entrepreneurship
- Evidence of dynamics from learning about return rather than saving out of financial constraints
  - households switch into enterprise after low productivity realization in agriculture
- Validate model predictions and structural estimates using data on expected incomes by enterprise history

Preview of Results

- Large positive average returns to entrepreneurship
- Sorting on heterogeneous returns (marginal return is low)
  - households with *high* earnings in default sector have *low* returns to entrepreneurship
- Evidence of dynamics from learning about return rather than saving out of financial constraints
  - households switch into enterprise after low productivity realization in agriculture
- Validate model predictions and structural estimates using data on expected incomes by enterprise history

Preview of Results

- Large positive average returns to entrepreneurship
- Sorting on heterogeneous returns (marginal return is low)
  - households with *high* earnings in default sector have *low* returns to entrepreneurship
- Evidence of dynamics from learning about return rather than saving out of financial constraints
  - households switch into enterprise after low productivity realization in agriculture
- Validate model predictions and structural estimates using data on expected incomes by enterprise history

Model: Setup

- 2 sectors: farm (default) and enterprise $j \in \{F, E\}$
- Farm: cropping (wage labor too)
- Enterprise: shop, trading, restaurant, etc.
- Cobb-Douglas production functions with sector-specific
  - productivity
  - capital/input

Model: Setup

- 2 sectors: farm (default) and enterprise $j \in \{F, E\}$
- Farm: cropping (wage labor too)
- Enterprise: shop, trading, restaurant, etc.
- Cobb-Douglas production functions with sector-specific
  - productivity
  - capital input

Model: Setup

- 2 sectors: farm (default) and enterprise $j \in \{F, E\}$
- Farm: cropping (wage labor too)
- Enterprise: shop, trading, restaurant, etc.
- Cobb-Douglas production functions with sector-specific
  - productivity
  - capital input

Model: Setup

- 2 sectors: farm (default) and enterprise $j \in \{F, E\}$
- Farm: cropping (wage labor too)
- Enterprise: shop, trading, restaurant, etc.
- Cobb-Douglas production functions with sector-specific
  - productivity
  - capital input

Model: Setup

- 2 components to productivity:
  - mean productivity, β_t^j
  - household-specific deviation from mean, η_i^j
- Household chooses in each period
  - optimal capital input level for each sector
  - entrepreneurship status by comparing optimized profits across sectors

Details

Model: Setup

- 2 components to productivity:
  - mean productivity, β_t^j
  - household-specific deviation from mean, η_i^j
- Household chooses in each period
  - optimal capital input level for each sector
  - entrepreneurship status by comparing optimized profits across sectors

▸ Details

Model: Comparative Advantage *(Roy (1951), Lemieux (1998) and Suri (2011))*

- Household-specific, sector-specific productivities (η_i^j) can be expressed in terms of
  - τ_i, represents absolute advantage (skills valued equally across sectors)
  - η_i, represents comparative advantage in entrepreneurship (skills valued differentially)
  - $(1+\phi)$, represents correlation of market's value of η_i across sectors
- Entrepreneurship decision driven by comparative advantage, η_i

▸ Details

Model: Comparative Advantage *(Roy (1951), Lemieux (1998) and Suri (2011))*

- Household-specific, sector-specific productivities (η_i^j) can be expressed in terms of
  - τ_i, represents absolute advantage (skills valued equally across sectors)
  - η_i, represents comparative advantage in entrepreneurship (skills valued differentially)
  - $(1+\phi)$, represents correlation of market's value of η_i across sectors
- Entrepreneurship decision driven by comparative advantage, η_i

▸ Details

Model: Comparative Advantage *(Roy (1951), Lemieux (1998) and Suri (2011))*

- Household-specific, sector-specific productivities (η_i^j) can be expressed in terms of
  - τ_i, represents absolute advantage (skills valued equally across sectors)
  - η_i, represents comparative advantage in entrepreneurship (skills valued differentially)
  - $(1+\phi)$, represents correlation of market's value of η_i across sectors
- Entrepreneurship decision driven by comparative advantage, η_i

▸ Details

Model: Comparative Advantage *(Roy (1951), Lemieux (1998) and Suri (2011))*

- Household-specific, sector-specific productivities (η_i^j) can be expressed in terms of
  - τ_i, represents absolute advantage (skills valued equally across sectors)
  - η_i, represents comparative advantage in entrepreneurship (skills valued differentially)
  - $(1+\phi)$, represents correlation of market's value of η_i across sectors
- Entrepreneurship decision driven by comparative advantage, η_i

▸ Details

Model: Learning *(Gibbons et al. 2005, DeGroot 1970)*

- Assume households know
  - average return to entrepreneurship ($\beta_t^E - \beta_t^F$)
  - return to capital $\rho^E \approx \rho^F \equiv \rho$
  - absolute advantage τ_i
  - correlation of earnings across sectors $(1 + \phi)$
- Imperfect information about $\eta_i \rightarrow (\eta_i + \varepsilon_{it})$

Model: Learning *(Gibbons et al. 2005, DeGroot 1970)*

- Assume households know
  - average return to entrepreneurship $(\beta_t^E - \beta_t^F)$
  - return to capital $\rho^E \approx \rho^F \equiv \rho$
  - absolute advantage τ_i
  - correlation of earnings across sectors $(1 + \phi)$
- Imperfect information about $\eta_i \rightarrow (\eta_i + \varepsilon_{it})$

Model: Learning *(Gibbons et al. 2005, DeGroot 1970)*

- Assume households know
  - average return to entrepreneurship $(\beta_t^E - \beta_t^F)$
  - return to capital $\rho^E \approx \rho^F \equiv \rho$
  - absolute advantage τ_i
  - correlation of earnings across sectors $(1 + \phi)$
- Imperfect information about $\eta_i \rightarrow (\eta_i + \varepsilon_{it})$

Model: Learning *(Gibbons et al. 2005, DeGroot 1970)*

- Assume households know
  - average return to entrepreneurship $(\beta_t^E - \beta_t^F)$
  - return to capital $\rho^E \approx \rho^F \equiv \rho$
  - absolute advantage τ_i
  - correlation of earnings across sectors $(1 + \phi)$
- Imperfect information about $\eta_i \rightarrow (\eta_i + \varepsilon_{it})$

Model: Learning *(Gibbons et al. 2005, DeGroot 1970)*

- Assume households know
  - average return to entrepreneurship $(\beta_t^E - \beta_t^F)$
  - return to capital $\rho^E \approx \rho^F \equiv \rho$
  - absolute advantage τ_i
  - correlation of earnings across sectors $(1 + \phi)$
- Imperfect information about $\eta_i \rightarrow (\eta_i + \varepsilon_{it})$

Model: Learning Intuition

- Comparative advantage in entrepreneurship, η_i
  - example: ratio of marketing skill to physical strength
- Household knows $(1 + \phi)$:
  - entrepreneurship values marketing skill more
  - farming values physical strength more
- Household doesn't know own realization on skill index

Details

Model: Learning Intuition

- Comparative advantage in entrepreneurship, η_i
  - example: ratio of marketing skill to physical strength
- Household knows $(1 + \phi)$:
  - entrepreneurship values marketing skill more
  - farming values physical strength more
- Household doesn't know own realization on skill index

▸ Details

Model: Learning Intuition

- Comparative advantage in entrepreneurship, η_i
  - example: ratio of marketing skill to physical strength
- Household knows $(1 + \phi)$:
  - entrepreneurship values marketing skill more
  - farming values physical strength more
- Household doesn't know own realization on skill index

▸ Details

Model: Learning *(Gibbons et al. 2005, DeGroot 1970)*

- Initial belief $\eta_i \sim N(m_{i0}, \sigma^2 = 1/h)$
- Observe output each period
- Calculate productivity signal independent of current entrepreneurial status $(\eta_i + \varepsilon_{it})$
- Martingale law of motion: $m_{i,t} = m_{i,t-1} + \xi_{it}$
- Series of one-off entrepreneurship decisions

▸ Details

Model: Learning *(Gibbons et al. 2005, DeGroot 1970)*

- Initial belief $\eta_i \sim N(m_{i0}, \sigma^2 = 1/h)$
- Observe output each period
- Calculate productivity signal independent of current entrepreneurial status $(\eta_i + \varepsilon_{it})$
- Martingale law of motion: $m_{i,t} = m_{i,t-1} + \xi_{it}$
- Series of one-off entrepreneurship decisions

▸ Details

Model: Learning *(Gibbons et al. 2005, DeGroot 1970)*

- Initial belief $\eta_i \sim N(m_{i0}, \sigma^2 = 1/h)$
- Observe output each period
- Calculate productivity signal independent of current entrepreneurial status ($\eta_i + \varepsilon_{it}$)
- Martingale law of motion: $m_{i,t} = m_{i,t-1} + \xi_{it}$
- Series of one-off entrepreneurship decisions

▸ Details

Model: Learning *(Gibbons et al. 2005, DeGroot 1970)*

- Initial belief $\eta_i \sim N(m_{i0}, \sigma^2 = 1/h)$
- Observe output each period
- Calculate productivity signal independent of current entrepreneurial status $(\eta_i + \varepsilon_{it})$
- Martingale law of motion: $m_{i,t} = m_{i,t-1} + \xi_{it}$
- Series of one-off entrepreneurship decisions

▸ Details

Model: Learning *(Gibbons et al. 2005, DeGroot 1970)*

- Initial belief $\eta_i \sim N(m_{i0}, \sigma^2 = 1/h)$
- Observe output each period
- Calculate productivity signal independent of current entrepreneurial status $(\eta_i + \varepsilon_{it})$
- Martingale law of motion: $m_{i,t} = m_{i,t-1} + \xi_{it}$
- Series of one-off entrepreneurship decisions

▸ Details

Model: Learning Intuition

- Learn about relative ability in entrepreneurship in either sector
  - low yield on farm, but good at selling crops $\rightarrow$ switch to enterprise
  - bad at trading, but able to work long hours $\rightarrow$ switch to farming
- Different from learning-by-doing
  - not new technology (livestock, tractor, hoe, etc.)

Details

Model: Learning Intuition

- Learn about relative ability in entrepreneurship in either sector
  - low yield on farm, but good at selling crops $\rightarrow$ switch to enterprise
  - bad at trading, but able to work long hours $\rightarrow$ switch to farming
- Different from learning-by-doing
  - not new technology (livestock, trader, shop, etc.)

▸ Details

Model: Learning Intuition

- Learn about relative ability in entrepreneurship in either sector
  - low yield on farm, but good at selling crops $\rightarrow$ switch to enterprise
  - bad at trading, but able to work long hours $\rightarrow$ switch to farming
- Different from learning-by-doing
  - not new technology (livestock, trader, shop, etc.)

▸ Details

Model: Learning Intuition

- Learn about relative ability in entrepreneurship in either sector
  - low yield on farm, but good at selling crops $\rightarrow$ switch to enterprise
  - bad at trading, but able to work long hours $\rightarrow$ switch to farming
- Different from learning-by-doing
  - not new technology (livestock, trader, shop, etc.)

▸ Details

Model: Credit Constraints

- Include one form of constraint: limited liability
- Estimation of returns robust to alternate forms
  - additional variables (e.g. assets, interest rates) only effect output through capital and sector
  - address endogeneity in sector and input decisions
  - interpretation and predicted signs of other structural parameters differ
- Distinguish ability from financial constraint in results

Details

Model: Credit Constraints

- Include one form of constraint: limited liability
- Estimation of returns robust to alternate forms
  - additional variables (e.g. assets, interest rates) only effect output through capital and sector
  - address endogeneity in sector and input decisions
  - interpretation and predicted signs of other structural parameters differ
- Distinguish ability from financial constraint in results

Details

Model: Credit Constraints

- Include one form of constraint: limited liability
- Estimation of returns robust to alternate forms
  - additional variables (e.g. assets, interest rates) only effect output through capital and sector
  - address endogeneity in sector and input decisions
  - interpretation and predicted signs of other structural parameters differ
- Distinguish ability from financial constraint in results

Details

Model: Credit Constraints

- Include one form of constraint: limited liability
- Estimation of returns robust to alternate forms
  - additional variables (e.g. assets, interest rates) only effect output through capital and sector
  - address endogeneity in sector and input decisions
  - interpretation and predicted signs of other structural parameters differ
- Distinguish ability from financial constraint in results

Details

Model: Credit Constraints

- Include one form of constraint: limited liability
- Estimation of returns robust to alternate forms
  - additional variables (e.g. assets, interest rates) only effect output through capital and sector
  - address endogeneity in sector and input decisions
  - interpretation and predicted signs of other structural parameters differ
- Distinguish ability from financial constraint in results

Details

Model: Credit Constraints

- Include one form of constraint: limited liability
- Estimation of returns robust to alternate forms
  - additional variables (e.g. assets, interest rates) only effect output through capital and sector
  - address endogeneity in sector and input decisions
  - interpretation and predicted signs of other structural parameters differ
- Distinguish ability from financial constraint in results

▸ Details

Empirical Strategy

- Let us consider $T = 2$

$$y_{it} = \alpha_t + \beta_t D_{it} + \rho k_{it} + (\eta_i + \varepsilon_{it})(1 + \phi D_{it}) + \tau_i + \zeta_{it} \qquad (1)$$

- $\alpha_t \equiv \beta_t^F$ and $\beta_t \equiv (\beta_t^E - \beta_t^F) = \beta \quad \forall t$
- $k_{it} \equiv k_{it}^F + (k_{it}^E - k_{it}^F) D_{it}$ and remember $\rho^F \approx \rho^E = \rho$
- measurement error ζ_{it} is assumed mean independent of D_{it} and k_{it} conditional on η_i and τ_i

Empirical Strategy

- Let us consider $T = 2$

$$y_{it} = \alpha_t + \beta_t D_{it} + \rho k_{it} + (\eta_i + \varepsilon_{it})(1 + \phi D_{it}) + \tau_i + \zeta_{it} \qquad (1)$$

- $\alpha_t \equiv \beta_t^F$ and $\beta_t \equiv (\beta_t^E - \beta_t^F) = \beta \quad \forall t$
- $k_{it} \equiv k_{it}^F + (k_{it}^E - k_{it}^F) D_{it}$ and remember $\rho^F \approx \rho^E = \rho$
- measurement error ζ_{it} is assumed mean independent of D_{it} and k_{it} conditional on η_i and τ_i

Empirical Strategy

- Let us consider $T = 2$

$$y_{it} = \alpha_t + \beta_t D_{it} + \rho k_{it} + (\eta_i + \varepsilon_{it})(1 + \phi D_{it}) + \tau_i + \zeta_{it} \qquad (1)$$

- $\alpha_t \equiv \beta_t^F$ and $\beta_t \equiv (\beta_t^E - \beta_t^F) = \beta \quad \forall t$
- $k_{it} \equiv k_{it}^F + (k_{it}^E - k_{it}^F) D_{it}$ and remember $\rho^F \approx \rho^E = \rho$
- measurement error ζ_{it} is assumed mean independent of D_{it} and k_{it} conditional on η_i and τ_i

Empirical Strategy

- Let us consider $T = 2$

$$y_{it} = \alpha_t + \beta_t D_{it} + \rho k_{it} + (\eta_i + \varepsilon_{it})(1 + \phi D_{it}) + \tau_i + \zeta_{it} \qquad (1)$$

- $\alpha_t \equiv \beta_t^F$ and $\beta_t \equiv (\beta_t^E - \beta_t^F) = \beta \quad \forall t$
- $k_{it} \equiv k_{it}^F + (k_{it}^E - k_{it}^F) D_{it}$ and remember $\rho^F \approx \rho^E = \rho$
- measurement error ζ_{it} is assumed mean independent of D_{it} and k_{it} conditional on η_i and τ_i

Empirical Strategy

$$y_{it} = \alpha_t + \beta D_{it} + \rho k_{it} + (\eta_i + \varepsilon_{it})(1 + \phi D_{it}) + \tau_i + \zeta_{it}$$

- D_{it} and k_{it} are chosen endogenously based on $m_{i,t-1}$
- OLS estimate of β and ρ will be biased
- $(1 + \phi)$ is of interest (correlation between earnings across sectors)

Empirical Strategy

$$y_{it} = \alpha_t + \beta D_{it} + \rho k_{it} + (\eta_i + \varepsilon_{it})(1 + \phi D_{it}) + \tau_i + \zeta_{it}$$

- D_{it} and k_{it} are chosen endogenously based on $m_{i,t-1}$
- OLS estimate of β and ρ will be biased
- $(1 + \phi)$ is of interest (correlation between earnings across sectors)

Empirical Strategy

$$y_{it} = \alpha_t + \beta D_{it} + \rho k_{it} + (\eta_i + \varepsilon_{it})(1 + \phi D_{it}) + \tau_i + \zeta_{it}$$

- D_{it} and k_{it} are chosen endogenously based on $m_{i,t-1}$
- OLS estimate of β and ρ will be biased
- $(1 + \phi)$ is of interest (correlation between earnings across sectors)

Empirical Strategy

$$y_{it} = \alpha_t + \beta D_{it} + \rho k_{it} + (\eta_i + \varepsilon_{it})(1 + \phi D_{it}) + \tau_i + \zeta_{it}$$

- D_{it} and k_{it} are chosen endogenously based on $m_{i,t-1}$
- OLS estimate of β and ρ will be biased
- $(1 + \phi)$ is of interest (correlation between earnings across sectors)

Empirical Strategy: Learning

- $m_{i,t} = m_{i,t-1} + \xi_{it} \quad \Rightarrow \quad m_{i,t-1} = m_{i0} + \sum_{k=1}^{t-1} \xi_{ik}$,
- m_{i0} will affect choices in all periods
- Updates, $m_i^{t-1} \equiv \sum_{k=1}^{t-1} \xi_{ik}$, are orthogonal to m_{i0}
- m_i^{t-1} will only affect choices in period t and onward
- $\eta_i + \varepsilon_{it} = m_{i0} + m_i^{t-1} + \varphi_{it}$

Empirical Strategy: Learning

- $m_{i,t} = m_{i,t-1} + \xi_{it} \quad \Rightarrow \quad m_{i,t-1} = m_{i0} + \sum_{k=1}^{t-1} \xi_{ik}$,
- m_{i0} will affect choices in all periods
- Updates, $m_i^{t-1} \equiv \sum_{k=1}^{t-1} \xi_{ik}$, are orthogonal to m_{i0}
- m_i^{t-1} will only affect choices in period t and onward
- $\eta_i + \varepsilon_{it} = m_{i0} + m_i^{t-1} + \varphi_{it}$

Empirical Strategy: Learning

- $m_{i,t} = m_{i,t-1} + \xi_{it} \quad \Rightarrow \quad m_{i,t-1} = m_{i0} + \sum_{k=1}^{t-1} \xi_{ik}$,
- m_{i0} will affect choices in all periods
- Updates, $m_i^{t-1} \equiv \sum_{k=1}^{t-1} \xi_{ik}$, are orthogonal to m_{i0}
- m_i^{t-1} will only affect choices in period t and onward
- $\eta_i + \varepsilon_{it} = m_{i0} + m_i^{t-1} + \varphi_{it}$

Empirical Strategy: Learning

- $m_{i,t} = m_{i,t-1} + \xi_{it} \quad \Rightarrow \quad m_{i,t-1} = m_{i0} + \sum_{k=1}^{t-1} \xi_{ik}$,
- m_{i0} will affect choices in all periods
- Updates, $m_i^{t-1} \equiv \sum_{k=1}^{t-1} \xi_{ik}$, are orthogonal to m_{i0}
- m_i^{t-1} will only affect choices in period t and onward
- $\eta_i + \varepsilon_{it} = m_{i0} + m_i^{t-1} + \varphi_{it}$

Empirical Strategy: Learning

- $m_{i,t} = m_{i,t-1} + \xi_{it} \quad \Rightarrow \quad m_{i,t-1} = m_{i0} + \sum_{k=1}^{t-1} \xi_{ik}$,
- m_{i0} will affect choices in all periods
- Updates, $m_i^{t-1} \equiv \sum_{k=1}^{t-1} \xi_{ik}$, are orthogonal to m_{i0}
- m_i^{t-1} will only affect choices in period t and onward
- $\eta_i + \varepsilon_{it} = m_{i0} + m_i^{t-1} + \varphi_{it}$

Empirical Strategy: Learning

$$y_{it} = \alpha_t + \beta D_{it} + \rho k_{it} + (m_{i0} + m_i^{t-1} + \varphi_{it})(1 + \phi D_{it}) + v_{it}, \qquad (2)$$

- $v_{it} \equiv \tau_i + \zeta_{it}$ and φ_{it} orthogonal to D_{it}
- All information to be used in entrepreneurship decision at time t is fully summarized in m_{i0} and m_i^{t-1}

Empirical Strategy: Learning

$$y_{it} = \alpha_t + \beta D_{it} + \rho k_{it} + (m_{i0} + m_i^{t-1} + \varphi_{it})(1 + \phi D_{it}) + v_{it}, \qquad (2)$$

- $v_{it} \equiv \tau_i + \zeta_{it}$ and φ_{it} orthogonal to D_{it}
- All information to be used in entrepreneurship decision at time t is fully summarized in m_{i0} and m_i^{t-1}

Empirical Strategy: Dynamic CRC

- Building on *Chamberlain (1982, 1984)*, can project m_{i0} and m_i^{t-1} onto history of choices
- Purge composite error of correlation with D_{it} and k_{it}
- Project m_{i0} on 3 entrepreneurship histories, 2 capital choices, and 6 interactions of capital and sector choices

$$m_{i0} = \Lambda_0(\lambda; \mathbf{D_i}, \mathbf{k_i}) + \psi_{i0} \tag{3}$$

- Project m_i^{t-1} on choices in period t onward, no interactions

$$m_i^{t-1} = \Theta_{t-1}(\theta_{\mathbf{t-1}}; \mathbf{D_i^t}, \mathbf{k_i^t}) + \psi_{i,t-1} \tag{4}$$

▸ Projections

Empirical Strategy: Reduced Form

$$
\begin{aligned}
y_{it} \quad = \quad & \alpha_t + \left[\Lambda_0(\lambda; \mathbf{D_i}, \mathbf{k_i}) + \Theta_{t-1}(\theta_{\mathbf{t-1}}; \mathbf{D_i^t}, \mathbf{k_i^t})\right](1 + \phi D_{it}) \\
& + \beta D_{it} + \rho k_{it} + (\psi_{i0} + \psi_{i,t-1} + \varphi_{it})(1 + \phi D_{it}) + v_{it}, \quad (5)
\end{aligned}
$$

- y_{it} as a function of entire history of entrepreneurship decisions
- Estimate these equations using seemingly unrelated regressions (SUR)
- Recover 22 reduced form coefficients

Empirical Strategy: Reduced Form

$$
\begin{aligned}
y_{it} \quad = \quad & \alpha_t + \left[\Lambda_0(\lambda; \mathbf{D_i}, \mathbf{k_i}) + \Theta_{t-1}(\theta_{\mathbf{t-1}}; \mathbf{D_i^t}, \mathbf{k_i^t})\right](1 + \phi D_{it}) \\
& + \beta D_{it} + \rho k_{it} + (\psi_{i0} + \psi_{i,t-1} + \varphi_{it})(1 + \phi D_{it}) + v_{it}, \quad (5)
\end{aligned}
$$

- y_{it} as a function of entire history of entrepreneurship decisions
- Estimate these equations using seemingly unrelated regressions (SUR)
- Recover 22 reduced form coefficients

Empirical Strategy: Reduced Form

$$
\begin{aligned}
y_{it} \quad = \quad & \alpha_t + \left[\Lambda_0(\lambda; \mathbf{D_i}, \mathbf{k_i}) + \Theta_{t-1}(\theta_{\mathbf{t-1}}; \mathbf{D_i^t}, \mathbf{k_i^t})\right](1 + \phi D_{it}) \\
& + \beta D_{it} + \rho k_{it} + (\psi_{i0} + \psi_{i,t-1} + \varphi_{it})(1 + \phi D_{it}) + v_{it}, \quad (5)
\end{aligned}
$$

- y_{it} as a function of entire history of entrepreneurship decisions
- Estimate these equations using seemingly unrelated regressions (SUR)
- Recover 22 reduced form coefficients

Empirical Strategy: Structural MD Estimates

- Model imposes relationship between 22 reduced form coefficients and 17 structural parameters
- 11 λ's estimate heterogeneity in initial beliefs
- 3 θ's estimate heterogeneity in belief update that drives switching
- β, ρ, and ϕ from model
- Estimate these structural parameters using minimum distance (MD)

Empirical Strategy: Structural MD Estimates

- Model imposes relationship between 22 reduced form coefficients and 17 structural parameters
- 11 λ's estimate heterogeneity in initial beliefs
- 3 θ's estimate heterogeneity in belief update that drives switching
- β, ρ, and ϕ from model
- Estimate these structural parameters using minimum distance (MD)

Empirical Strategy: Structural MD Estimates

- Model imposes relationship between 22 reduced form coefficients and 17 structural parameters
- 11 λ's estimate heterogeneity in initial beliefs
- 3 θ's estimate heterogeneity in belief update that drives switching
- β, ρ, and ϕ from model
- Estimate these structural parameters using minimum distance (MD)

Empirical Strategy: Structural MD Estimates

- Model imposes relationship between 22 reduced form coefficients and 17 structural parameters
- 11 λ's estimate heterogeneity in initial beliefs
- 3 θ's estimate heterogeneity in belief update that drives switching
- β, ρ, and ϕ from model
- Estimate these structural parameters using minimum distance (MD)

Empirical Strategy: Structural MD Estimates

- Model imposes relationship between 22 reduced form coefficients and 17 structural parameters
- 11 λ's estimate heterogeneity in initial beliefs
- 3 θ's estimate heterogeneity in belief update that drives switching
- β, ρ, and ϕ from model
- Estimate these structural parameters using minimum distance (MD)

Empirical Strategy: Parameter Interpretation

- β is average return to entrepreneurship
- ρ is average return to capital
- $(1 + \phi)$ is correlation of earnings across sectors
  - if $\phi > 0$, good farmers are good at enterprise
  - if $\phi < 0$, less income inequality

Empirical Strategy: Parameter Interpretation

- β is average return to entrepreneurship
- ρ is average return to capital
- $(1 + \phi)$ is correlation of earnings across sectors
  - if $\phi > 0$, good farmers are good at enterprise
  - if $\phi < 0$, less income inequality

Empirical Strategy: Parameter Interpretation

- β is average return to entrepreneurship
- ρ is average return to capital
- $(1 + \phi)$ is correlation of earnings across sectors
  - if $\phi > 0$, good farmers are good at enterprise
  - if $\phi < 0$, less income inequality

Empirical Strategy: Identification

- Compare conditional sample means of income across households and time
- Condition on household's entire history of choices
- Identified from within household switching of entrepreneurship status and input expenditure

▸ Threats to Identification

Empirical Strategy: Identification

- Compare conditional sample means of income across households and time
- Condition on household's entire history of choices
- Identified from within household switching of entrepreneurship status and input expenditure

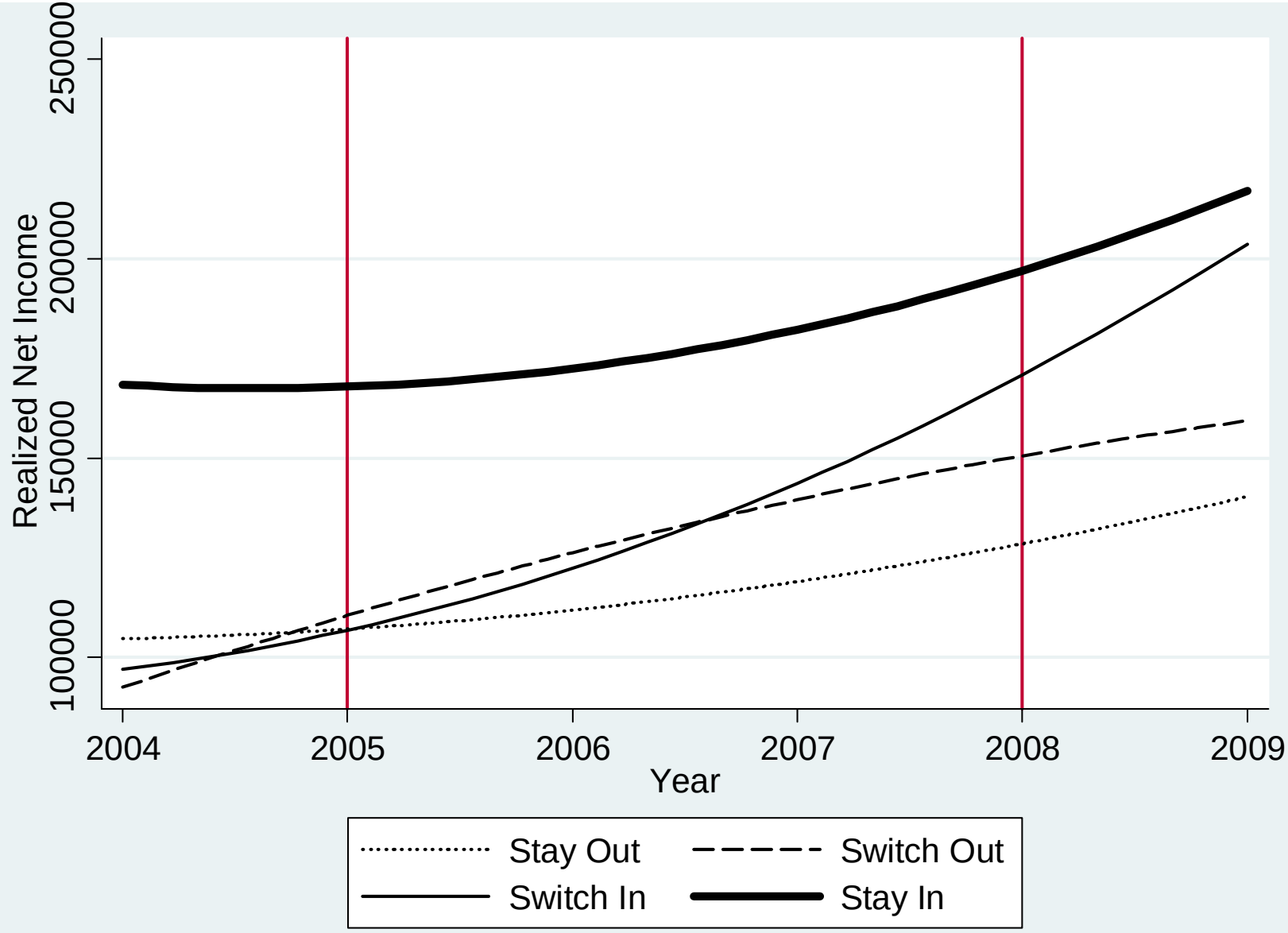
▸ Threats to Identification

Empirical Strategy: Identification

- Compare conditional sample means of income across households and time
- Condition on household's entire history of choices
- Identified from within household switching of entrepreneurship status and input expenditure

▸ Threats to Identification

Identification: Income By Entrepreneurship History



Data

- Townsend Thai Project data from 2005 and 2008
- 4 provinces: 2 from rural Northeast region and 2 from urban Central region
- Balanced panel includes 1103 households

▸ Sum Stats

Data

- Townsend Thai Project data from 2005 and 2008
- 4 provinces: 2 from rural Northeast region and 2 from urban Central region
- Balanced panel includes 1103 households

▸ Sum Stats

Data

- Townsend Thai Project data from 2005 and 2008
- 4 provinces: 2 from rural Northeast region and 2 from urban Central region
- Balanced panel includes 1103 households

▸ Sum Stats

Data

- Information on income and expenditure in agriculture, wage labor, and enterprise
- Information on expected income next year, savings and self-reported credit constraints
- Over 40% of HHs have enterprises in each wave
- Over 20% of HHs switch enterprise status

▸ Sum Stats ▸ Labor

Data

- Information on income and expenditure in agriculture, wage labor, and enterprise
- Information on expected income next year, savings and self-reported credit constraints
- Over 40% of HHs have enterprises in each wave
- Over 20% of HHs switch enterprise status

▸ Sum Stats ▸ Labor

Data

- Information on income and expenditure in agriculture, wage labor, and enterprise
- Information on expected income next year, savings and self-reported credit constraints
- Over 40% of HHs have enterprises in each wave
- Over 20% of HHs switch enterprise status

▸ Sum Stats ▸ Labor

Data

- Information on income and expenditure in agriculture, wage labor, and enterprise
- Information on expected income next year, savings and self-reported credit constraints
- Over 40% of HHs have enterprises in each wave
- Over 20% of HHs switch enterprise status

▸ Sum Stats ▸ Labor

Data

- 3 main types of businesses (in order of prevalence):
  - shop (convenience store, food store, noodle shop / restaurant, repair shop, barber, etc.)
  - trader
  - fish/shrimp and other livestock
- roughly 22% of enterprise households get majority of income from business
- roughly 11% of enterprise households hire paid employees

▸ Sum Stats

Data

- 3 main types of businesses (in order of prevalence):
  - shop (convenience store, food store, noodle shop / restaurant, repair shop, barber, etc.)
  - trader
  - fish/shrimp and other livestock
- roughly 22% of enterprise households get majority of income from business
- roughly 11% of enterprise households hire paid employees

▸ Sum Stats

Data

- 3 main types of businesses (in order of prevalence):
  - shop (convenience store, food store, noodle shop / restaurant, repair shop, barber, etc.)
  - trader
  - fish/shrimp and other livestock
- roughly 22% of enterprise households get majority of income from business
- roughly 11% of enterprise households hire paid employees

▸ Sum Stats

Structural Estimates

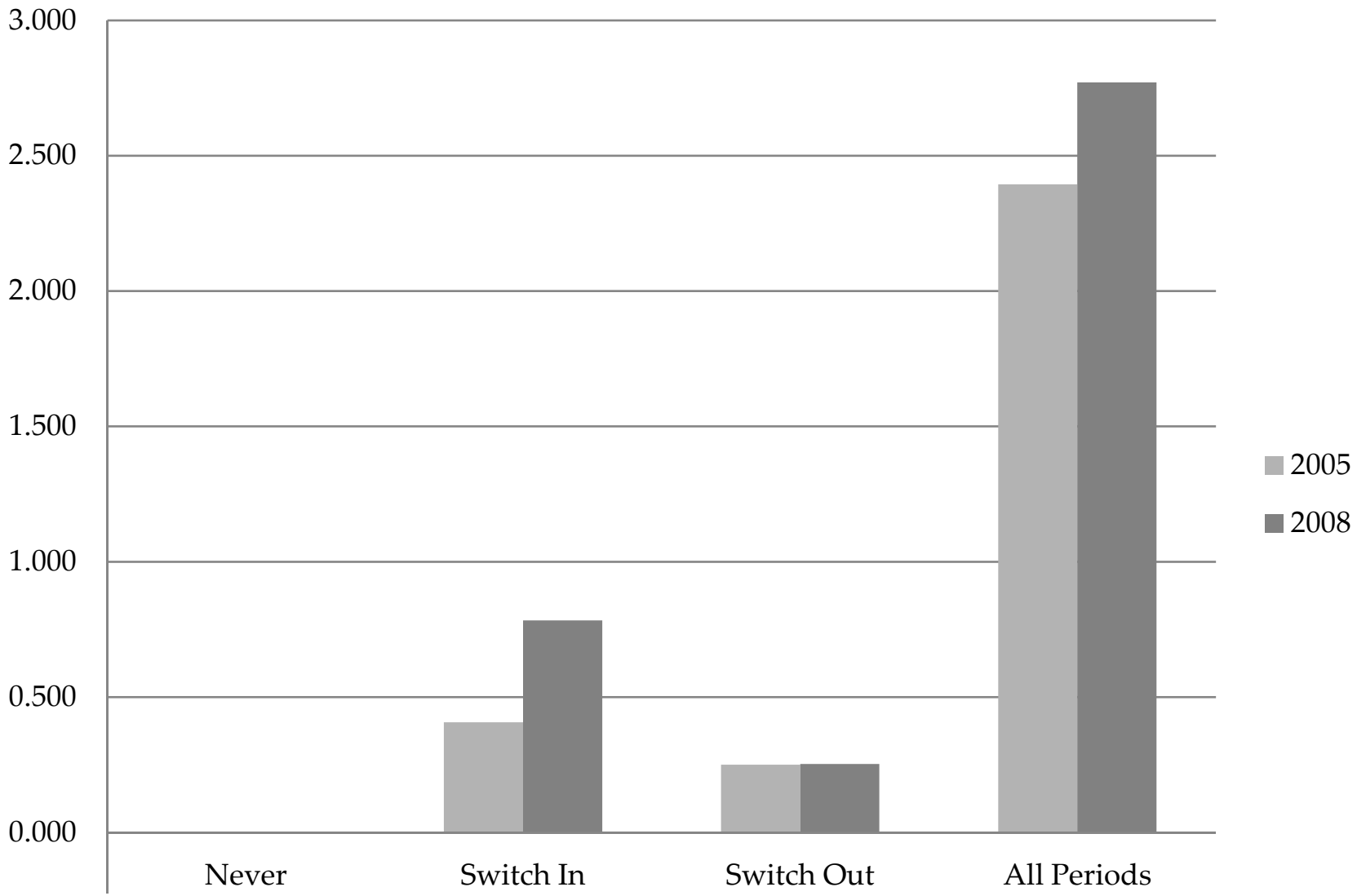
	CRE	DCRE	CRC	DCRC
ρ	0.0595***	0.0638***	0.0671***	0.0726***
	(0.0087)	(0.0098)	(0.0102)	(0.0119)
β	0.1858***	0.1633***	0.2191***	0.2408***
	(0.0510)	(0.0607)	(0.0647)	(0.0878)
ϕ			-0.3052	-0.4614**
			(0.2113)	(0.2149)
χ^2	85.1951	84.2665	14.9055	13.149
df	16	14	8	5
obs	1103	1103	1103	1103
p-value	<0.0001	<0.0001	0.061	0.022

▸ OLS ▸ FE ▸ No Covariates

Structural Estimates (Village x Time Dummies)

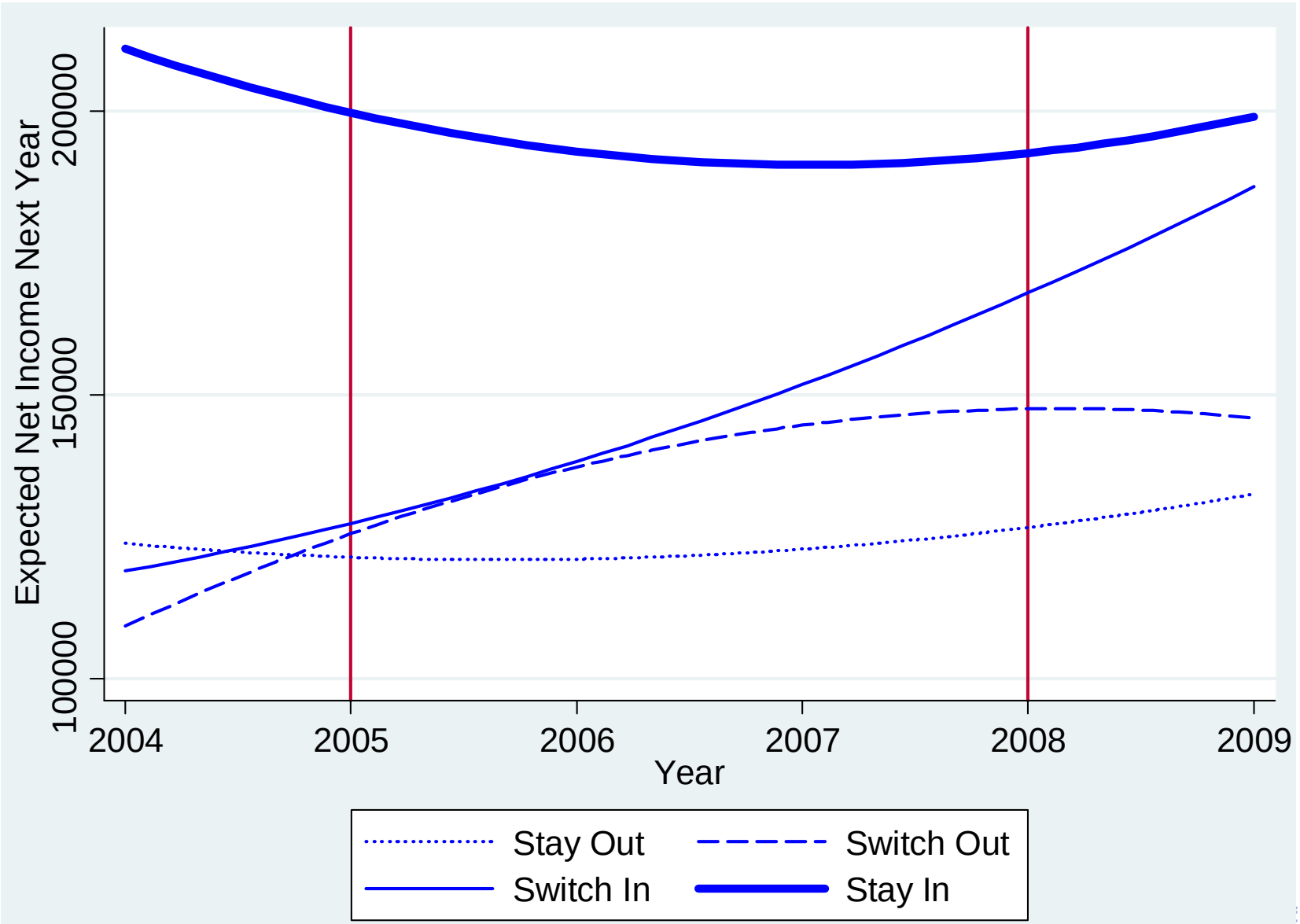
	CRE	DCRE	CRC	DCRC
ρ	0.0608***	0.0610***	0.0641***	0.0686***
	(0.0084)	(0.0095)	(0.0095)	(0.0119)
β	0.1764***	0.1688***	0.2287**	0.3512***
	(0.0519)	(0.0631)	(0.1138)	(0.1166)
ϕ			-0.1432	-0.5512*
			(0.3476)	(0.2947)
χ^2	67.2846	67.2263	12.8105	9.2845
df	16	14	8	5
obs	1103	1103	1103	1103
p-value	<0.0001	<0.0001	0.1185	0.0982

Perceived Gains ($\beta + \phi m_{i,t-1}$)

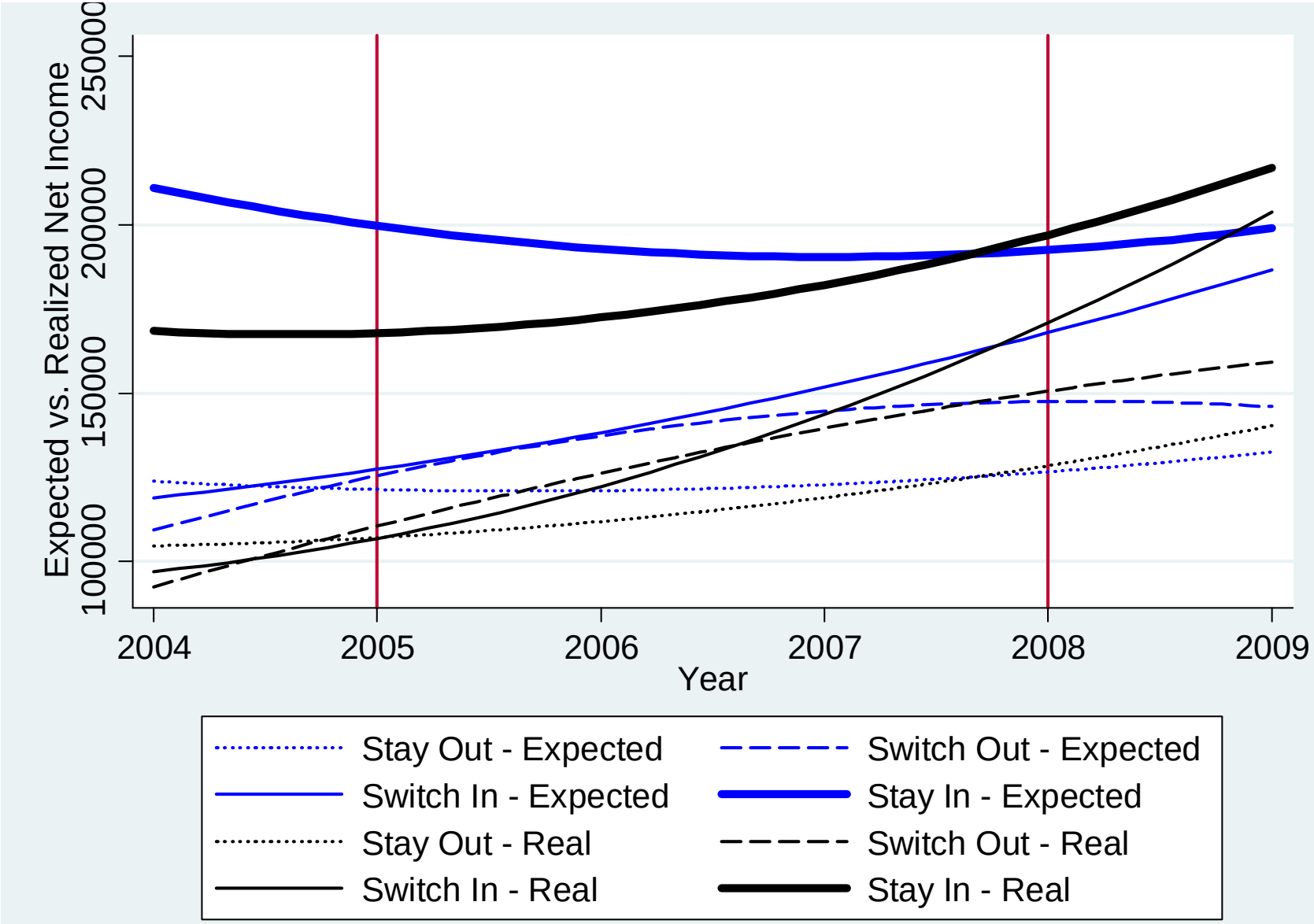


▸ Projection Coefficients

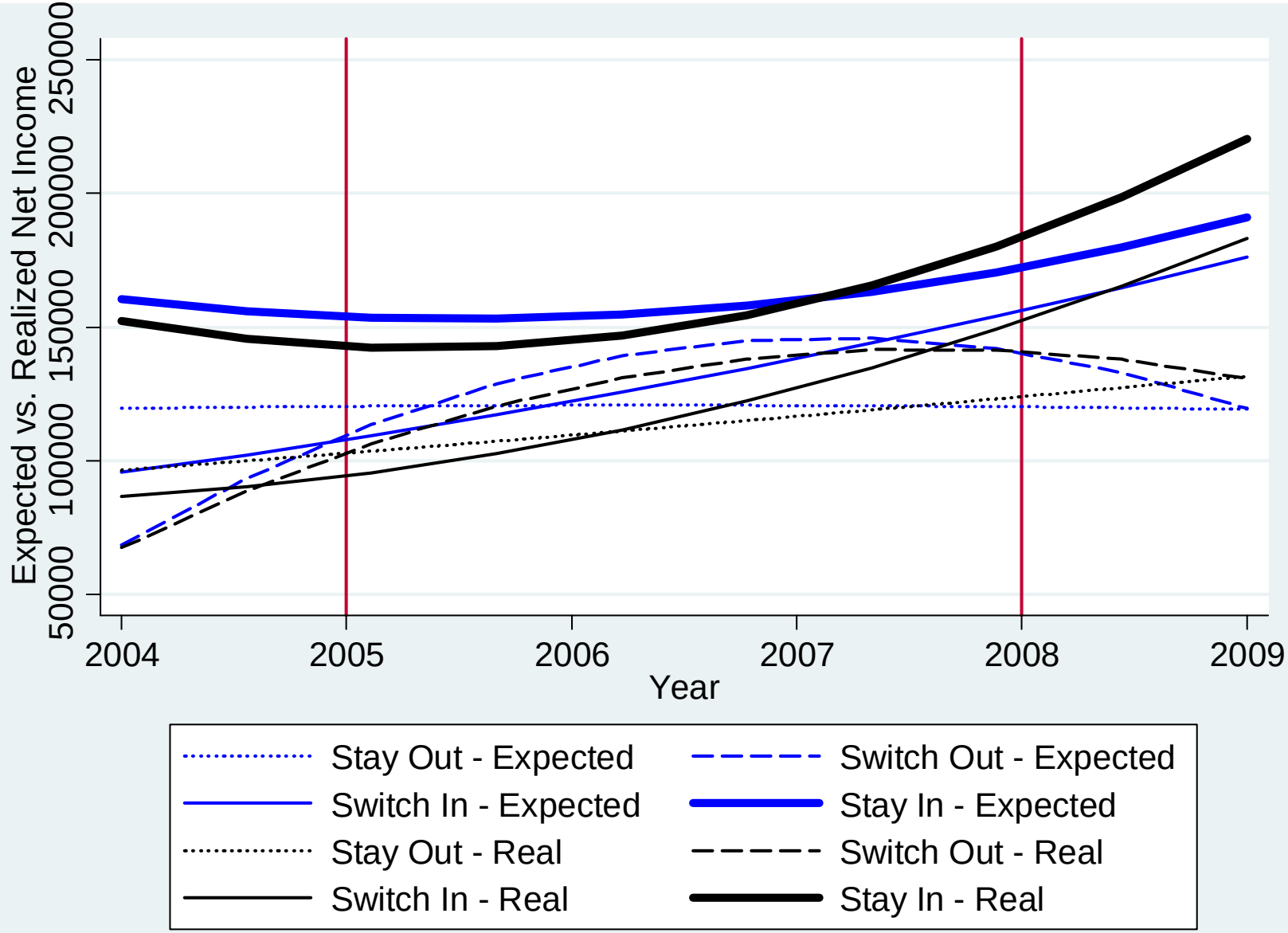
Learning: Expected Income Next Year By Entrepreneurship History



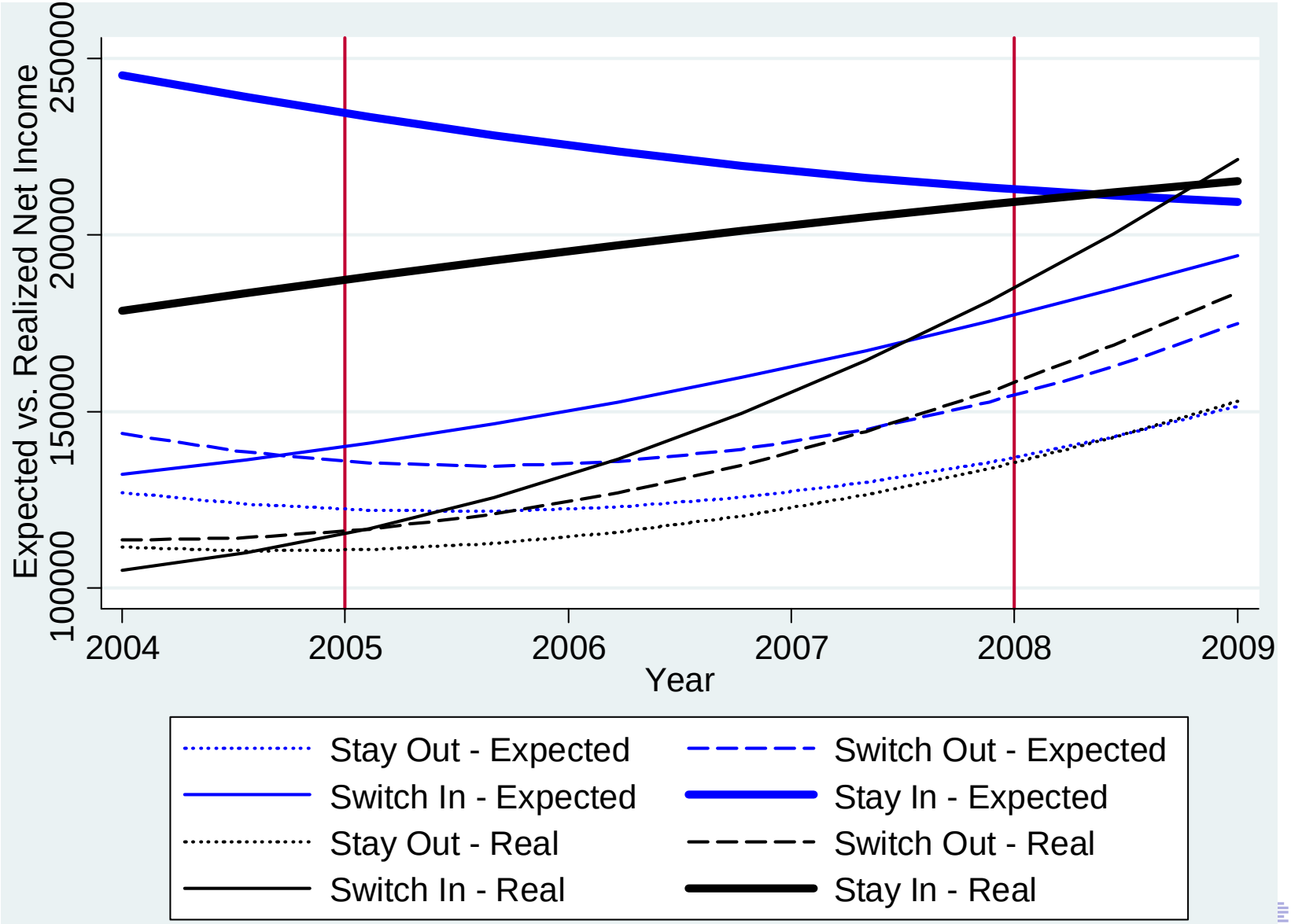
Learning: Real vs. Expected Income By Entrepreneurship History



Learning: Real vs. Expected Income - Older Households



Learning: Real vs. Expected Income - Younger Households



Summary of Results

- Large average return to entrepreneurship
- Households sort on heterogeneous returns (marginal return is low)
  - households with *high* earnings in default sector have *low* returns to entrepreneurship
- Suggestive evidence of learning about heterogeneous return
- Households learn about comparative advantage in entrepreneurship from
  - negative shocks in default sector
  - positive shocks in entrepreneurial sector

Summary of Results

- Large average return to entrepreneurship
- Households sort on heterogeneous returns (marginal return is low)
  - households with *high* earnings in default sector have *low* returns to entrepreneurship
- Suggestive evidence of learning about heterogeneous return
- Households learn about comparative advantage in entrepreneurship from
  - negative shocks in default sector
  - positive shocks in entrepreneurial sector

Summary of Results

- Large average return to entrepreneurship
- Households sort on heterogeneous returns (marginal return is low)
  - households with *high* earnings in default sector have *low* returns to entrepreneurship
- Suggestive evidence of learning about heterogeneous return
- Households learn about comparative advantage in entrepreneurship from
  - negative shocks in default sector
  - positive shocks in entrepreneurial sector

Summary of Results

- Large average return to entrepreneurship
- Households sort on heterogeneous returns (marginal return is low)
  - households with *high* earnings in default sector have *low* returns to entrepreneurship
- Suggestive evidence of learning about heterogeneous return
- Households learn about comparative advantage in entrepreneurship from
  - negative shocks in default sector
  - positive shocks in entrepreneurial sector

Comparison of Alternate Models

Empirical facts to be matched:

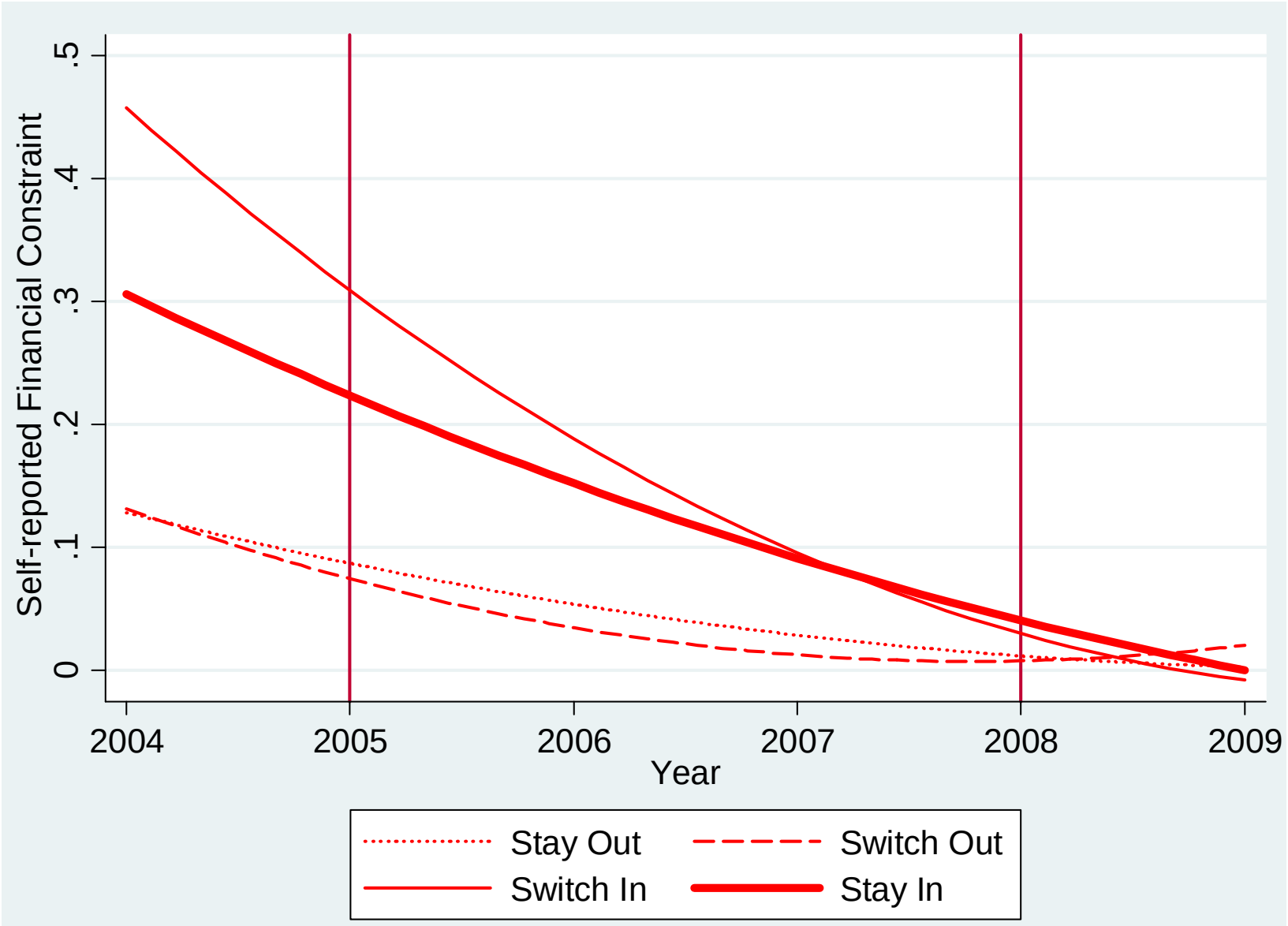
1. Stable aggregate enterprise participation
2. High frequency switching of enterprise status
3. Negative shocks drive switching
4. Persistence of productivity innovations
5. Reduced switching over time

Comparison of Alternate Models

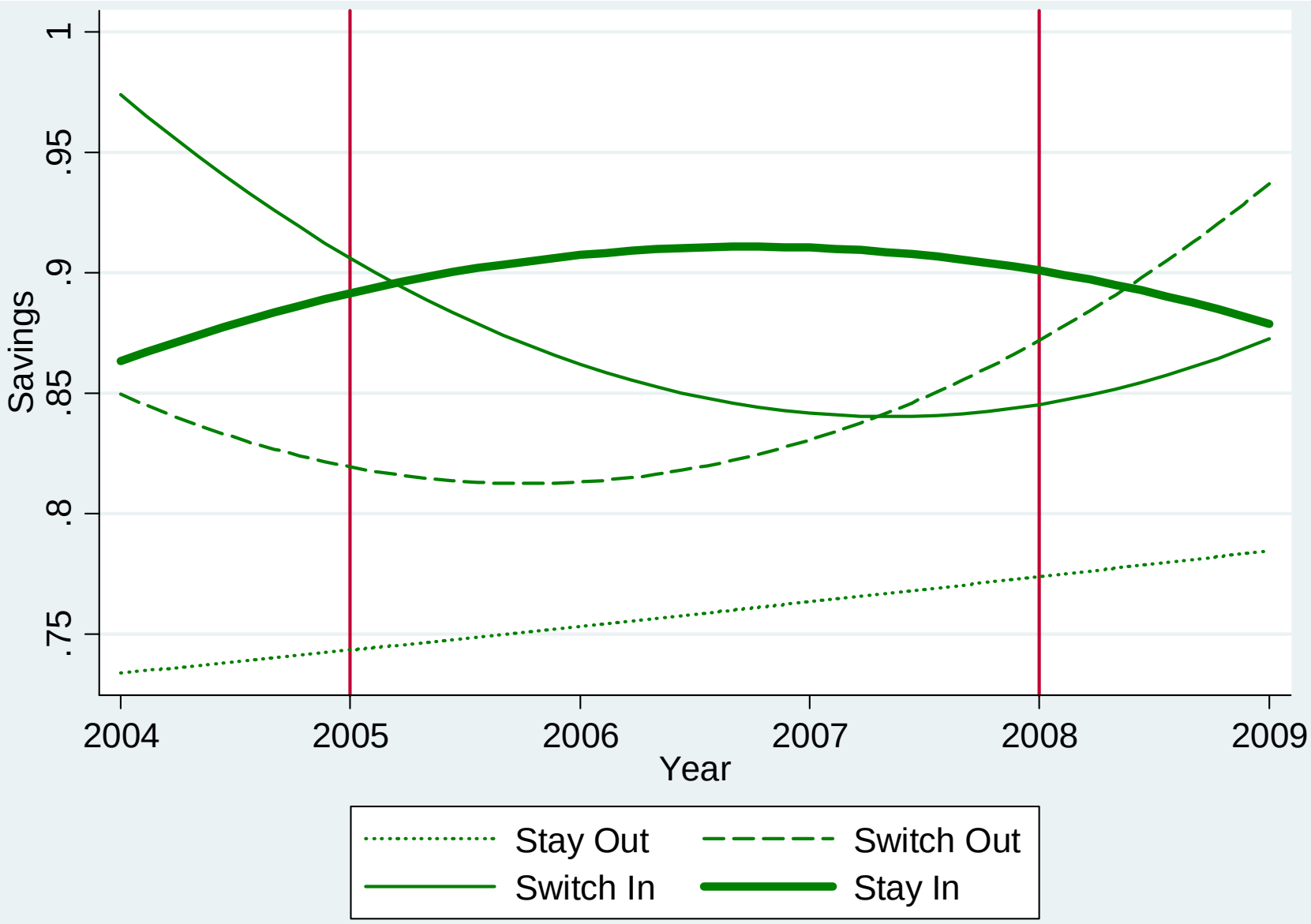
Households save out of financial constraints:

1. Stable aggregate enterprise participation **Fail**
2. High frequency switching of enterprise status **Pass**
3. Negative shocks drive switching **Fail**
4. Persistence of productivity innovations **Pass**
5. Reduced switching over time **Pass**

Financial Constraints By Entrepreneurship History



Savings By Entrepreneurship History



Comparison of Alternate Models

Heterogeneous returns, learning-by-doing:

1. Stable aggregate enterprise participation **Fail**
2. High frequency switching of enterprise status **Pass**
3. Negative shocks drive switching **Fail**
4. Persistence of productivity innovations **Pass**
5. Reduced switching over time **Pass**

Comparison of Alternate Models

Persistent shocks to η_j, no learning:

1. Stable aggregate enterprise participation **Pass**
2. High frequency switching of enterprise status **Pass**
3. Negative shocks drive switching **Pass**
4. Persistence of productivity innovations **Pass**
5. Reduced switching over time **Fail**

Related Work: Switching and Smoothing

- Health and enterprise in Tanzania (with Ach Adhvaryu)
  - households use enterprise activity to weather acute health shocks
  - extensive margin (entry) and intensive margins (capital and labor allocations)
  - entire household (both sick and non-sick members) shifts labor allocation
  - apparent complementarity in labor inputs emphasizes importance of access to alternate technologies

Related Work: Switching and Smoothing

- Health and enterprise in Tanzania (with Ach Adhvaryu)
  - households use enterprise activity to weather acute health shocks
  - extensive margin (entry) and intensive margins (capital and labor allocations)
  - entire household (both sick and non-sick members) shifts labor allocation
  - apparent complementarity in labor inputs emphasizes importance of access to alternate technologies

Related Work: Switching and Smoothing

- Health and enterprise in Tanzania (with Ach Adhvaryu)
  - households use enterprise activity to weather acute health shocks
  - extensive margin (entry) and intensive margins (capital and labor allocations)
  - entire household (both sick and non-sick members) shifts labor allocation
  - apparent complementarity in labor inputs emphasizes importance of access to alternate technologies

Related Work: Switching and Smoothing

- Health and enterprise in Tanzania (with Ach Adhvaryu)
  - households use enterprise activity to weather acute health shocks
  - extensive margin (entry) and intensive margins (capital and labor allocations)
  - entire household (both sick and non-sick members) shifts labor allocation
  - apparent complementarity in labor inputs emphasizes importance of access to alternate technologies

Related Work: Switching and Smoothing

- Agricultural profitability and enterprise (with Ach Adhvaryu and Namrata Kala)
  - coffee price down: some households switch into enterprise
  - coffee price up: some divest, reduce or discontinue enterprise activity; others *expand* enterprises
  - can we predict differential response from observable baseline characteristics of household *(e.g. demographic composition, schooling or cognitive skills)* or enterprise *(employment, contribution to household income, proportion of labor hours)*?
  - help to target the earnest entrepreneurs

Related Work: Switching and Smoothing

- Agricultural profitability and enterprise (with Ach Adhvaryu and Namrata Kala)
  - coffee price down: some households switch into enterprise
  - coffee price up: some divest, reduce or discontinue enterprise activity; others *expand* enterprises
  - can we predict differential response from observable baseline characteristics of household *(e.g. demographic composition, schooling or cognitive skills)* or enterprise *(employment, contribution to household income, proportion of labor hours)*?
  - help to target the earnest entrepreneurs

Related Work: Switching and Smoothing

- Agricultural profitability and enterprise (with Ach Adhvaryu and Namrata Kala)
  - coffee price down: some households switch into enterprise
  - coffee price up: some divest, reduce or discontinue enterprise activity; others *expand* enterprises
  - can we predict differential response from observable baseline characteristics of household *(e.g. demographic composition, schooling or cognitive skills)* or enterprise *(employment, contribution to household income, proportion of labor hours)*?
  - help to target the earnest entrepreneurs

Related Work: Switching and Smoothing

- Agricultural profitability and enterprise (with Ach Adhvaryu and Namrata Kala)
  - coffee price down: some households switch into enterprise
  - coffee price up: some divest, reduce or discontinue enterprise activity; others *expand* enterprises
  - can we predict differential response from observable baseline characteristics of household *(e.g. demographic composition, schooling or cognitive skills)* or enterprise *(employment, contribution to household income, proportion of labor hours)*?
  - help to target the earnest entrepreneurs

The End

- Thanks!

Policy Implications

- Marginal non-entrant has low gross return to (low ability in) entrepreneurship
  - allocation of financial resources to lowering his cost might not be welfare-enhancing
  - improving his entrepreneurial skill might be a better endeavor
  - improving skills of labor force might improve long-run growth of enterprises

Policy Implications

- Marginal non-entrant has low gross return to (low ability in) entrepreneurship
  - allocation of financial resources to lowering his cost might not be welfare-enhancing
  - improving his entrepreneurial skill might be a better endeavor
  - improving skills of labor force might improve long-run growth of enterprises

Policy Implications

- Marginal non-entrant has low gross return to (low ability in) entrepreneurship
  - allocation of financial resources to lowering his cost might not be welfare-enhancing
  - improving his entrepreneurial skill might be a better endeavor
  - improving skills of labor force might improve long-run growth of enterprises

Policy Implications

- Marginal non-entrant has low gross return to (low ability in) entrepreneurship
  - allocation of financial resources to lowering his cost might not be welfare-enhancing
  - improving his entrepreneurial skill might be a better endeavor
  - improving skills of labor force might improve long-run growth of enterprises

Model: Production Functions

$$D_{it} = 0: \qquad Y_{it}^F = e^{\beta_t^F} K_{iFt}^{\rho^F} e^{\eta_i^F}, \tag{6}$$

$$D_{it} = 1: \qquad Y_{it}^E = e^{\beta_t^E} K_{iEt}^{\rho^E} e^{\eta_i^E}, \tag{7}$$

- D_{it} is a dummy for household i producing in entrepreneurial sector in period t
- K_{iFt}^F and K_{iFt}^E are capital inputs in the two sectors
- ρ^F and ρ^E are factor loadings on capital in the two sectors

Back

Model: Production Functions

$$D_{it} = 0: \qquad Y_{it}^{F} = e^{\beta_t^F} K_{iFt}^{\rho^F} e^{\eta_i^F}, \tag{6}$$

$$D_{it} = 1: \qquad Y_{it}^{E} = e^{\beta_t^E} K_{iEt}^{\rho^E} e^{\eta_i^E}, \tag{7}$$

- D_{it} is a dummy for household i producing in entrepreneurial sector in period t
- K_{iFt}^{F} and K_{iFt}^{E} are capital inputs in the two sectors
- ρ^F and ρ^E are factor loadings on capital in the two sectors

Back

Model: Production Functions

$$D_{it} = 0: \qquad Y_{it}^{F} = e^{\beta_t^F} K_{iFt}^{\rho^F} e^{\eta_i^F}, \tag{6}$$

$$D_{it} = 1: \qquad Y_{it}^{E} = e^{\beta_t^E} K_{iEt}^{\rho^E} e^{\eta_i^E}, \tag{7}$$

- D_{it} is a dummy for household i producing in entrepreneurial sector in period t
- K_{iFt}^{F} and K_{iFt}^{E} are capital inputs in the two sectors
- ρ^F and ρ^E are factor loadings on capital in the two sectors

Back

Model: Production Functions

$$D_{it} = 0: \qquad Y_{it}^F = e^{\beta_t^F} K_{iFt}^{\rho^F} e^{\eta_i^F},$$

$$D_{it} = 1: \qquad Y_{it}^E = e^{\beta_t^E} K_{iEt}^{\rho^E} e^{\eta_i^E},$$

- β_t^F and β_t^E are mean productivities in the two sectors
- η_i^F and η_i^E are heterogeneous components of productivity productivities in the two sectors

Back

Model: Production Functions

$$D_{it} = 0: \qquad Y_{it}^F = e^{\beta_t^F} K_{iFt}^{\rho^F} e^{\eta_i^F},$$

$$D_{it} = 1: \qquad Y_{it}^E = e^{\beta_t^E} K_{iEt}^{\rho^E} e^{\eta_i^E},$$

- β_t^F and β_t^E are mean productivities in the two sectors
- η_i^F and η_i^E are heterogeneous components of productivity productivities in the two sectors

Back

Model: Capital Input

- Assuming cost of capital is r; no adjustment cost
- In each sector $j \in \{E, F\}$, household solves

$$\max_{K_{ijt}} \left[e^{\beta_t^j} K_{ijt}^{\rho^j} e^{\eta_i^j} - r K_{ijt} \right] \tag{8}$$

- Household's period t optimal input in sector j is

$$K_{ijt}^* = \kappa\left(\eta_i^j; r, \rho^j\right) \tag{9}$$

Back

Model: Sectoral Choice

- Then, $D_{it} = 1$ iff $\left[e^{\beta_t^E} K_{iEt}^{\rho^E} e^{\eta_i^E} - rK_{iEt}^*\right] > \left[e^{\beta_t^F} K_{iFt}^{\rho^F} e^{\eta_i^F} - rK_{iFt}^*\right]$
- Substitute in for K_{iEt}^* and K_{iFt}^*
- Make simplifying assumption $\rho^E \approx \rho^F \equiv \rho$
- Household i will choose to produce in the entrepreneurial sector iff:

$$e^{(\eta_i^E - \eta_i^F)} > e^{(\beta_t^F - \beta_t^E)} \tag{10}$$

Back

Model: Comparative Advantage *(Roy (1951), Lemieux (1998) and Suri (2011))*

- Sectoral choice depends on $(\eta_i^E - \eta_i^F)$
- Only the relative magnitude of η_i^F and η_i^E can be identified
- Project η_i^F and η_i^E onto relative productivity in entrepreneurship over default production, $(\eta_i^E - \eta_i^F)$

$$\eta_i^F = b_F(\eta_i^E - \eta_i^F) + \tau_i \quad (11)$$

$$\eta_i^E = b_E(\eta_i^E - \eta_i^F) + \tau_i \quad (12)$$

Back

Model: Comparative Advantage *(Roy (1951), Lemieux (1998) and Suri (2011))*

- Household's *absolute advantage* is represented by τ_i
- τ_i has the same effect on the household's productivity in both sectors

$$\eta_i^F = b_F(\eta_i^E - \eta_i^F) + \tau_i$$

$$\eta_i^E = b_E(\eta_i^E - \eta_i^F) + \tau_i$$

Back

Model: Comparative Advantage *(Roy (1951), Lemieux (1998) and Suri (2011))*

- Defining household's *comparative advantage* $\eta_i \equiv b_F(\eta_i^E - \eta_i^F)$
- Defining $\phi \equiv b_E/b_F - 1$

$$\eta_i^F = \eta_i + \tau_i \quad (13)$$

$$\eta_i^E = (1+\phi)\eta_i + \tau_i \quad (14)$$

Back

Model: Generalized Output Equation

- Substituting in and taking logs:

$$y_{it}^F = \beta_t^F + \rho k_{it}^F + \eta_i + \tau_i \quad (15)$$

$$y_{it}^E = \beta_t^E + \rho k_{it}^E + (1+\phi)\eta_i + \tau_i \quad (16)$$

- Generalized, log gross output equation (D_{it} is entrepreneurship dummy):

$$y_{it} = \beta_t^F + (\beta_t^E - \beta_t^F)D_{it} + \rho[k_{it}^F + (k_{it}^E - k_{it}^F)D_{it}] + \eta_i(1+\phi D_{it}) + \tau_i$$

Model: Perfect Information

$$y_{it} = \beta_t^F + (\beta_t^E - \beta_t^F)D_{it} + \rho[k_{it}^F + (k_{it}^E - k_{it}^F)D_{it}] + \eta_i(1 + \phi D_{it}) + \tau_i$$

- All market participants know
  - average productivity: β_t^F and β_t^E
  - return to capital: ρ
  - absolute advantage: τ_i (unobserved)
  - covariance of productivity across sectors, ϕ, given η_i
- perfect information about $\eta_i \rightarrow$ static selection on comparative advantage

Back

Model: Perfect Information

$$y_{it} = \beta_t^F + (\beta_t^E - \beta_t^F)D_{it} + \rho[k_{it}^F + (k_{it}^E - k_{it}^F)D_{it}] + \eta_i(1 + \phi D_{it}) + \tau_i$$

- All market participants know
  - average productivity: β_t^F and β_t^E
  - return to capital: ρ
  - absolute advantage: τ_i (unobserved)
  - covariance of productivity across sectors, ϕ, given η_i
- perfect information about $\eta_i \rightarrow$ static selection on comparative advantage

Back

Model: Perfect Information

$$y_{it} = \beta_t^F + (\beta_t^E - \beta_t^F)D_{it} + \rho[k_{it}^F + (k_{it}^E - k_{it}^F)D_{it}] + \eta_i(1 + \phi D_{it}) + \tau_i$$

- All market participants know
  - average productivity: β_t^F and β_t^E
  - return to capital: ρ
  - absolute advantage: τ_i (unobserved)
  - covariance of productivity across sectors, ϕ, given η_i
- perfect information about $\eta_i \rightarrow$ static selection on comparative advantage

Back

Model: Perfect Information

$$y_{it} = \beta_t^F + (\beta_t^E - \beta_t^F)D_{it} + \rho[k_{it}^F + (k_{it}^E - k_{it}^F)D_{it}] + \eta_i(1 + \phi D_{it}) + \tau_i$$

- All market participants know
  - average productivity: β_t^F and β_t^E
  - return to capital: ρ
  - absolute advantage: τ_i (unobserved)
  - covariance of productivity across sectors, ϕ, given η_i
- perfect information about $\eta_i \rightarrow$ static selection on comparative advantage

Back

Model: Perfect Information

$$y_{it} = \beta_t^F + (\beta_t^E - \beta_t^F)D_{it} + \rho[k_{it}^F + (k_{it}^E - k_{it}^F)D_{it}] + \eta_i(1 + \phi D_{it}) + \tau_i$$

- All market participants know
  - average productivity: β_t^F and β_t^E
  - return to capital: ρ
  - absolute advantage: τ_i (unobserved)
  - covariance of productivity across sectors, ϕ, given η_i
- perfect information about $\eta_i \rightarrow$ static selection on comparative advantage

Back

Model: Imperfect Information

$$\begin{aligned} y_{it} &= \beta_t^F + (\beta_t^E - \beta_t^F)D_{it} + \rho[k_{it}^F + (k_{it}^E - k_{it}^F)D_{it}] \\ &\quad + (\eta_i + \varepsilon_{it})(1 + \phi D_{it}) + \tau_i \end{aligned} \tag{17}$$

- Imperfect information about η_i
- Replace η_i with $(\eta_i + \varepsilon_{it})$
- Random error: $\varepsilon_{it} \sim N(0, \sigma_\varepsilon^2 = 1/h_\varepsilon)$

Back

Model: Imperfect Information

$$\begin{aligned} y_{it} &= \beta_t^F + (\beta_t^E - \beta_t^F)D_{it} + \rho[k_{it}^F + (k_{it}^E - k_{it}^F)D_{it}] \\ &\quad + (\eta_i + \varepsilon_{it})(1 + \phi D_{it}) + \tau_i \end{aligned} \tag{17}$$

- Imperfect information about η_i
- Replace η_i with $(\eta_i + \varepsilon_{it})$
- Random error: $\varepsilon_{it} \sim N(0, \sigma_\varepsilon^2 = 1/h_\varepsilon)$

Back

Model: Imperfect Information

$$\begin{aligned} y_{it} &= \beta_t^F + (\beta_t^E - \beta_t^F)D_{it} + \rho[k_{it}^F + (k_{it}^E - k_{it}^F)D_{it}] \\ &\quad + (\eta_i + \varepsilon_{it})(1 + \phi D_{it}) + \tau_i \end{aligned} \tag{17}$$

- Imperfect information about η_i
- Replace η_i with $(\eta_i + \varepsilon_{it})$
- Random error: $\varepsilon_{it} \sim N(0, \sigma_\varepsilon^2 = 1/h_\varepsilon)$

Back

Model: Learning *(Gibbons et al. 2005, DeGroot 1970)*

- Can compute noisy signal of comparative advantage each period, independent of sectoral choice
- Let $l_i^t = (l_{i1}, ..., l_{it})$ denote the history of the normalized comparative advantage observations up to period t

$$\begin{aligned} l_{it} &= \frac{y_{it} - \beta_t^F - (\beta_t^E - \beta_t^F)D_{it} - \rho[k_{it}^F + (k_{it}^E - k_{it}^F)D_{it}] - \tau_i}{(1 + \phi D_{it})} \\ &= \eta_i + \varepsilon_{it}, \end{aligned} \tag{18}$$

Back

Model: Learning *(Gibbons et al. 2005, DeGroot 1970)*

- Initial belief $\eta_i \sim N(m_{i0}, \sigma^2 = 1/h)$
- Posterior distribution of η_i given history I_i^t is $N(m_t(I_i^t), 1/h_t)$, where

$$m_t(I_i^t) = \frac{h m_{i0} + h_\varepsilon(I_{i1} + ... + I_{it})}{h + t h_\varepsilon}, \quad \text{and} \quad h_t = h + t h_\varepsilon \quad (19)$$

Back

Model: Learning *(Gibbons et al. 2005, DeGroot 1970)*

- Bayesian beliefs are a martingale
- $m_{i,t}$ is shorthand for $m_t(I_i^t)$
- Law of motion: $m_{i,t} = m_{i,t-1} + \xi_{it}$
- ξ_{it} is a noise term orthogonal to $m_{i,t-1}$

Back

Model: Learning *(Gibbons et al. 2005, DeGroot 1970)*

- Bayesian beliefs are a martingale
- $m_{i,t}$ is shorthand for $m_t(I_i^t)$
- Law of motion: $m_{i,t} = m_{i,t-1} + \xi_{it}$
- ξ_{it} is a noise term orthogonal to $m_{i,t-1}$

Back

Model: Learning *(Gibbons et al. 2005, DeGroot 1970)*

- Bayesian beliefs are a martingale
- $m_{i,t}$ is shorthand for $m_t(I_i^t)$
- Law of motion: $m_{i,t} = m_{i,t-1} + \xi_{it}$
- ξ_{it} is a noise term orthogonal to $m_{i,t-1}$

Back

Model: Learning *(Gibbons et al. 2005, DeGroot 1970)*

- Bayesian beliefs are a martingale
- $m_{i,t}$ is shorthand for $m_t(I_i^t)$
- Law of motion: $m_{i,t} = m_{i,t-1} + \xi_{it}$
- ξ_{it} is a noise term orthogonal to $m_{i,t-1}$

Back

Model: Timing

1. Household i chooses D_{it} and K_{ijt} at the beginning of period t using $m_{i,t-1} \equiv m_{t-1}(I_i^{t-1})$
2. Household i produces y_{it} during period t and observes the productivity shock ε_{it}
3. End of period t, household i calculates productivity signal and updates expectation of η_i according to law of motion

Model: Timing

1. Household i chooses D_{it} and K_{ijt} at the beginning of period t using $m_{i,t-1} \equiv m_{t-1}(I_i^{t-1})$
2. Household i produces y_{it} during period t and observes the productivity shock ε_{it}
3. End of period t, household i calculates productivity signal and updates expectation of η_i according to law of motion

Model: Timing

1. Household i chooses D_{it} and K_{ijt} at the beginning of period t using $m_{i,t-1} \equiv m_{t-1}(I_i^{t-1})$
2. Household i produces y_{it} during period t and observes the productivity shock ε_{it}
3. End of period t, household i calculates productivity signal and updates expectation of η_i according to law of motion

Model: Capital Input (Learning)

- In each sector $j \in \{E, F\}$, household solves

$$\max_{K_{ijt}} E_t \left[e^{\beta_t^j} K_{ijt}^{\rho^j} e^{\eta_i^j} - rK_{ijt} \right]$$

- where the expectation is with respect to beliefs at *beginning* of period t, $E_t[\eta_i] = m_{i,t-1}$

$$K_{iEt}^* = \kappa\left(m_{i,t-1}, \phi; r, \rho\right) \tag{20}$$

$$K_{iFt}^* = \kappa\left(m_{i,t-1}; r, \rho\right) \tag{21}$$

▸ Capital Equations

Model: Sectoral Choice (Learning)

- Substitute in for K^*_{iEt} and K^*_{iFt}
- Take logs, as in estimation
- Household produces in entrepreneurial sector in period t iff:

$$
\begin{aligned}
m_{i,t-1} &> \frac{-(\beta^E_t - \beta^F_t) - (1/2)\phi^2\sigma^2_t}{\phi}, \quad \text{if} \quad \phi > 0 \\
m_{i,t-1} &< \frac{-(\beta^E_t - \beta^F_t) - (1/2)\phi^2\sigma^2_t}{\phi}, \quad \text{if} \quad \phi < 0 \qquad (22)
\end{aligned}
$$

Back

Model: Sectoral Choice (Learning)

- Sign of ϕ determines which direction of evolution in $m_{i,t-1}$ will drive switching
  - $\phi > 0 \quad \rightarrow$ *upward* evolution predicts entry
  - $\phi < 0 \quad \rightarrow$ *downward* evolution predicts entry

$$m_{i,t-1} > \frac{-(\beta_t^E - \beta_t^F) - (1/2)\phi^2\sigma_t^2}{\phi}, \quad \text{if} \quad \phi > 0$$

$$m_{i,t-1} < \frac{-(\beta_t^E - \beta_t^F) - (1/2)\phi^2\sigma_t^2}{\phi}, \quad \text{if} \quad \phi < 0$$

Back

Model: Sectoral Choice (Learning)

- Sign of ϕ determines which direction of evolution in $m_{i,t-1}$ will drive switching
  - $\phi > 0 \quad \rightarrow$ *upward* evolution predicts entry
  - $\phi < 0 \quad \rightarrow$ *downward* evolution predicts entry

$$m_{i,t-1} > \frac{-(\beta_t^E - \beta_t^F) - (1/2)\phi^2\sigma_t^2}{\phi}, \quad \text{if} \quad \phi > 0$$

$$m_{i,t-1} < \frac{-(\beta_t^E - \beta_t^F) - (1/2)\phi^2\sigma_t^2}{\phi}, \quad \text{if} \quad \phi < 0$$

Back

Model: Sectoral Choice (Learning)

- Sign of ϕ determines which direction of evolution in $m_{i,t-1}$ will drive switching
  - $\phi > 0 \quad \rightarrow$ *upward* evolution predicts entry
  - $\phi < 0 \quad \rightarrow$ *downward* evolution predicts entry

$$m_{i,t-1} > \frac{-(\beta_t^E - \beta_t^F) - (1/2)\phi^2\sigma_t^2}{\phi}, \quad \text{if} \quad \phi > 0$$

$$m_{i,t-1} < \frac{-(\beta_t^E - \beta_t^F) - (1/2)\phi^2\sigma_t^2}{\phi}, \quad \text{if} \quad \phi < 0$$

Back

Model: Limited Liability

- Suppose now household i inputs $(A_{it} + K_{ijt})$ in sector j
  - A_{it} is household's beginning-of-period t savings (exogenous)
  - K_{ijt} is additional capital that is borrowed (or lent)
- When household borrows, it has option to default

Back

Model: Limited Liability

- Suppose now household i inputs $(A_{it} + K_{ijt})$ in sector j
  - A_{it} is household's beginning-of-period t savings (exogenous)
  - K_{ijt} is additional capital that is borrowed (or lent)
- When household borrows, it has option to default

Back

Model: Limited Liability

- Suppose now household i inputs $(A_{it} + K_{ijt})$ in sector j
  - A_{it} is household's beginning-of-period t savings (exogenous)
  - K_{ijt} is additional capital that is borrowed (or lent)
- When household borrows, it has option to default

Back

Model: Limited Liability

- If household repays, it receives payoff:

$$e^{\beta_t^j} K_{ijt}^{\rho^j} e^{\eta_i^j} + r(A_{it} - K_{ijt}), \tag{23}$$

- If household defaults, it receives payoff:

$$e^{\beta_t^j} K_{ijt}^{\rho^j} e^{\eta_i^j} - \pi A_{it}, \tag{24}$$

- where π is the fraction of assets A_{it} put up as collateral

Back

Model: Credit Constraints

- Lenders will only lend up to $\left(1+\frac{\pi}{r}\right)A_{it}$ in equilibrium
- Households constrained if

$$m_{i,t-1} > \Gamma\left(\pi, r, A_{it}\right) \quad \rightarrow \quad K^*_{ijt} = \left(1+\frac{\pi}{r}\right)A_{it}$$

- Otherwise, K^*_{ijt} as in unconstrained case

$$K^*_{iEt} = \kappa\left(m_{i,t-1}, \phi; r, \rho; \pi, A_{it}\right) \tag{25}$$

$$K^*_{iFt} = \kappa\left(m_{i,t-1}; r, \rho; \pi, A_{it}\right) \tag{26}$$

▸ Constraint Equation ▸ Back

Model: Credit Constraints

- Plug capital inputs into sectoral choice cutoff rule, as in unconstrained case
- D_{it} will now also be a function of constraint, which is itself a function of π, r, A_{it} and $m_{i,t-1}$
- π, r, A_{it} have no effect on output except through K^*_{ijt} and D_{it}
- Address correlation between $m_{i,t-1}$ and choices, K^*_{ijt} and D_{it}, in empirical strategy
- Robust to treating A_{it} as a choice variable

Back

Model: Credit Constraints

- Plug capital inputs into sectoral choice cutoff rule, as in unconstrained case
- D_{it} will now also be a function of constraint, which is itself a function of π, r, A_{it} and $m_{i,t-1}$
- π, r, A_{it} have no effect on output except through K^*_{ijt} and D_{it}
- Address correlation between $m_{i,t-1}$ and choices, K^*_{ijt} and D_{it}, in empirical strategy
- Robust to treating A_{it} as a choice variable

Back

Model: Credit Constraints

- Plug capital inputs into sectoral choice cutoff rule, as in unconstrained case
- D_{it} will now also be a function of constraint, which is itself a function of π, r, A_{it} and $m_{i,t-1}$
- π, r, A_{it} have no effect on output except through K^*_{ijt} and D_{it}
- Address correlation between $m_{i,t-1}$ and choices, K^*_{ijt} and D_{it}, in empirical strategy
- Robust to treating A_{it} as a choice variable

Back

Model: Credit Constraints

- Plug capital inputs into sectoral choice cutoff rule, as in unconstrained case
- D_{it} will now also be a function of constraint, which is itself a function of π, r, A_{it} and $m_{i,t-1}$
- π, r, A_{it} have no effect on output except through K^*_{ijt} and D_{it}
- Address correlation between $m_{i,t-1}$ and choices, K^*_{ijt} and D_{it}, in empirical strategy
- Robust to treating A_{it} as a choice variable

Back

Model: Credit Constraints

- Plug capital inputs into sectoral choice cutoff rule, as in unconstrained case
- D_{it} will now also be a function of constraint, which is itself a function of π, r, A_{it} and $m_{i,t-1}$
- π, r, A_{it} have no effect on output except through K^*_{ijt} and D_{it}
- Address correlation between $m_{i,t-1}$ and choices, K^*_{ijt} and D_{it}, in empirical strategy
- Robust to treating A_{it} as a choice variable

Back

Model: Capital Input (Unconstrained)

- Then, for $D_{it} = 1$,

$$K^*_{iEt} = E_t\left[\left(\frac{\rho^E e^{\beta^E_t + (1+\phi)\eta_i + \tau_i}}{r}\right)^{\frac{1}{1-\rho^E}}\right] \tag{27}$$

- For $D_{it} = 0$,

$$K^*_{iFt} = E_t\left[\left(\frac{\rho^F e^{\beta^F_t + \eta_i + \tau_i}}{r}\right)^{\frac{1}{1-\rho^F}}\right] \tag{28}$$

Back

Model: Credit Constraints

- Lenders learn at same rate as household and observe sector choice, constrained if $\lambda \equiv \left(1 + \frac{\pi}{r}\right)$

$$m_{i,t-1} > \left(\ln\left[(\lambda A_{it})^{1-\rho} \frac{r}{\rho}\right] - \beta_t^F - (\beta_t^E - \beta_t^F) D_{it} - \tau_i \right) \frac{1}{1 + \phi D_{it}}$$

- $\rightarrow \quad K_{ijt}^* = \lambda A_{it}$
- Otherwise, K_{ijt}^* as in unconstrained case

$$K_{ijt}^* = \kappa' \left(E_t[\eta_i], r, A_{it}, \pi \right)$$

Back

Empirical Strategy: Dynamic CRC

- 2 period, endogenous capital projections:

$$
\begin{aligned}
m_{i0} &= \lambda_0 + \lambda_1 D_{i1} + \lambda_2 D_{i2} + \lambda_3 D_{i1} D_{i2} + \lambda_{k1} k_{i1} + \lambda_{k2} k_{i2} \\
&\quad + \lambda_{k1\_1} k_{i1} D_{i1} + \lambda_{k1\_2} k_{i1} D_{i2} + \lambda_{k1\_12} k_{i1} D_{i1} D_{i2} \\
&\quad + \lambda_{k2\_1} k_{i2} D_{i1} + \lambda_{k2\_2} k_{i2} D_{i2} + \lambda_{k2\_12} k_{i2} D_{i1} D_{i2} + \psi_{i0} \\
m_i^1 &= \theta_0 + \theta_2 D_{i2} + \theta_{k2} k_{i2} + \theta_{k2\_2} k_{i2} D_{i2} + \psi_{i1}
\end{aligned}
$$

Back

Empirical Strategy: Threats to Identification

- Sequential exogeneity: unpredictable current and future productivity shocks
  - If households predict shocks, current choices still endogenous
- Households know distribution of returns given realization of relative ability, but not own ability
  - If don't know distribution, becomes dynamic programming problem
- Projections are "complete"
  - If unobserved productive decisions, returns not consistently estimated

Back

Empirical Strategy: Threats to Identification

- Sequential exogeneity: unpredictable current and future productivity shocks
  - If households predict shocks, current choices still endogenous
- Households know distribution of returns given realization of relative ability, but not own ability
  - If don't know distribution, becomes dynamic programming problem
- Projections are "complete"
  - If unobserved productive decisions, returns not consistently estimated

Back

Empirical Strategy: Threats to Identification

- Sequential exogeneity: unpredictable current and future productivity shocks
  - If households predict shocks, current choices still endogenous
- Households know distribution of returns given realization of relative ability, but not own ability
  - If don't know distribution, becomes dynamic programming problem
- Projections are "complete"
  - If unobserved productive decisions, returns not consistently estimated

Back

Labor

- Data on labor input is unavailable
- Omission of labor does not affect estimation under some assumptions
  - no market for entrepreneurial labor
  - household composition is either fixed or subject only to exogenous shocks
  - leisure is not valued

Back

Labor

- Data on labor input is unavailable
- Omission of labor does not affect estimation under some assumptions
  - no market for entrepreneurial labor
  - household composition is either fixed or subject only to exogenous shocks
  - leisure is not valued

Back

Labor

- Data on labor input is unavailable
- Omission of labor does not affect estimation under some assumptions
  - no market for entrepreneurial labor
  - household composition is either fixed or subject only to exogenous shocks
  - leisure is not valued

Back

Labor

- Data on labor input is unavailable
- Omission of labor does not affect estimation under some assumptions
  - no market for entrepreneurial labor
  - household composition is either fixed or subject only to exogenous shocks
  - leisure is not valued

Back

Labor Checks: No Market

	Business Owner		Unpaid Family Worker		Wage Employee	
	Mean	SD	Mean	SD	Mean	SD
All Entrepreneurial Industries	0.258	0.438	0.144	0.351	0.043	0.203
Fish or Shrimp Farming	0.033	0.178	0.032	0.175	0.029	0.169
Raising Livestock	0.149	0.356	0.086	0.280	0.033	0.178
Shop / Mechanic	0.076	0.265	0.054	0.226	0.037	0.188
Trade	0.098	0.297	0.063	0.242	0.033	0.178
All Default Industries	0.457	0.498	0.388	0.487	0.419	0.494
Farm	0.456	0.498	0.334	0.472	0.214	0.411
Construction	0.030	0.172	0.029	0.169	0.076	0.265
Low Skilled (Factory, Janitorial, etc.)	0.030	0.170	0.087	0.282	0.144	0.351
High Skilled (Nurse, Teacher, Accountant, etc.)	0.030	0.170	0.030	0.170	0.118	0.323

Back

Labor Checks: Household Composition Fixed

	Mean	SD
1(Change in Household Size)	0.551	0.498
1(Change in Number of Males)	0.430	0.495
1(Change in Number of Primary Educated)	0.514	0.500
1(Change in Number of Unemployed, Inactive, In School)	0.503	0.500

Back

Labor Checks: Exogenous Composition Changes

	Household Business	
	OLS	FE
Household Size	0.0170	0.00672
	(0.0109)	(0.0188)
Number of Males	-0.0145	-0.0180
	(0.0149)	(0.0276)
Number of Primary Educated	0.0616***	0.0138
	(0.0112)	(0.0184)
Number of Unemployed, Inactive, In School	-0.0526***	-0.0207
	(0.0120)	(0.0167)
Observations	2,206	2,206
R-squared	0.0482	0.0324

Back

Labor

- No market for entrepreneurial labor
- Changes to composition appear exogenous
  - number of primary educated and number of active laborers contribute to η_l
  - household size and number of males contribute to π_l
- Cannot check valuation of leisure

Back

Labor

- No market for entrepreneurial labor
- Changes to composition appear exogenous
  - number of primary educated and number of active laborers contribute to η_i
  - household size and number of males contribute to τ_i
- Cannot check valuation of leisure

Back

Labor

- No market for entrepreneurial labor
- Changes to composition appear exogenous
  - number of primary educated and number of active laborers contribute to η_i
  - household size and number of males contribute to τ_i
- Cannot check valuation of leisure

Back

Labor

- No market for entrepreneurial labor
- Changes to composition appear exogenous
  - number of primary educated and number of active laborers contribute to η_i
  - household size and number of males contribute to τ_i
- Cannot check valuation of leisure

Back

Labor

- No market for entrepreneurial labor
- Changes to composition appear exogenous
  - number of primary educated and number of active laborers contribute to η_i
  - household size and number of males contribute to τ_i
- Cannot check valuation of leisure

Back

Nested Models: CRC

- Comparative advantage with perfect information

$$y_{it} = \alpha_t + \beta D_{it} + \overbrace{\eta_i}^{\text{no shock, } \varepsilon_{it}} (1 + \phi D_{it}) + \tau_i + \zeta_{it} \tag{29}$$

- A single projection of η_i on sector choices, capital choices, and interactions

Back

Nested Models: CRC

- 3 restrictions on full model: θ's $= 0$
- 14 remaining structural parameters:
  - 11 λ's estimate correlations of choices with *known* comparative advantage
  - ρ, β, and ϕ are as in preferred model

Back

Nested Models: CRC

- 3 restrictions on full model: θ's $= 0$
- 14 remaining structural parameters:
  - 11 λ's estimate correlations of choices with *known* comparative advantage
  - ρ, β, and ϕ are as in preferred model

Back

Nested Models: CRC

- 3 restrictions on full model: θ's $= 0$
- 14 remaining structural parameters:
  - 11 λ's estimate correlations of choices with *known* comparative advantage
  - ρ, β, and ϕ are as in preferred model

Back

Nested Models: CRC

- 3 restrictions on full model: θ's $= 0$
- 14 remaining structural parameters:
  - 11 λ's estimate correlations of choices with *known* comparative advantage
  - ρ, β, and ϕ are as in preferred model

Back

Nested Models: DCRE

- Homogeneous return with imperfect information

$$y_{it} = \alpha_t + \beta D_{it} + \overbrace{(\eta_i + \varepsilon_{it})}^{\text{no slope component, } \phi D_{it}} + \tau_i + \zeta_{it} \tag{30}$$

- η_i is household's *unknown* part of fixed effect that affects choices
- Histories no longer matter:
  - project m_{i0} on sector and capital choices, no interactions
  - project m_{it}^{t-1} on choices in period t onwards, no interactions

Back

Nested Models: DCRE

- Homogeneous return with imperfect information

$$y_{it} = \alpha_t + \beta D_{it} + \overbrace{(\eta_i + \varepsilon_{it})}^{\text{no slope component, } \phi D_{it}} + \tau_i + \zeta_{it} \tag{30}$$

- η_i is household's *unknown* part of fixed effect that affects choices
- Histories no longer matter:
  - project m_{i0} on sector and capital choices, no interactions
  - project m_i^{t-1} on choices in period t onward, no interactions

Back

Nested Models: DCRE

- Homogeneous return with imperfect information

$$y_{it} = \alpha_t + \beta D_{it} + \overbrace{(\eta_i + \varepsilon_{it})}^{\text{no slope component, } \phi D_{it}} + \tau_i + \zeta_{it} \tag{30}$$

- η_i is household's *unknown* part of fixed effect that affects choices
- Histories no longer matter:
  - project m_{i0} on sector and capital choices, no interactions
  - project m_i^{t-1} on choices in period t onward, no interactions

Back

Nested Models: DCRE

- Homogeneous return with imperfect information

$$y_{it} = \alpha_t + \beta D_{it} + \overbrace{(\eta_i + \varepsilon_{it})}^{\text{no slope component, } \phi D_{it}} + \tau_i + \zeta_{it} \tag{30}$$

- η_i is household's *unknown* part of fixed effect that affects choices
- Histories no longer matter:
  - project m_{i0} on sector and capital choices, no interactions
  - project m_i^{t-1} on choices in period t onward, no interactions

Back

Nested Models: DCRE

- 9 restrictions on full model: 7 of the λ's $= 0$, 1 of the θ's $= 0$ and $\phi = 0$
- 8 remaining structural parameters:
  - 4 λ's estimate differences in initial belief of entrepreneurs vs. non-entrepreneurs in each period
  - 2 θ's estimate updates that drive switching
  - ρ and β are as in preferred model

Back

Nested Models: DCRE

- 9 restrictions on full model: 7 of the λ's $= 0$, 1 of the θ's $= 0$ and $\phi = 0$
- 8 remaining structural parameters:
  - 4 λ's estimate differences in initial belief of entrepreneurs vs. non-entrepreneurs in each period
  - 2 θ's estimate updates that drive switching
  - ρ and β are as in preferred model

Back

Nested Models: DCRE

- 9 restrictions on full model: 7 of the λ's $= 0$, 1 of the θ's $= 0$ and $\phi = 0$
- 8 remaining structural parameters:
  - 4 λ's estimate differences in initial belief of entrepreneurs vs. non-entrepreneurs in each period
  - 2 θ's estimate updates that drive switching
  - ρ and β are as in preferred model

Back

Nested Models: DCRE

- 9 restrictions on full model: 7 of the λ's $= 0$, 1 of the θ's $= 0$ and $\phi = 0$
- 8 remaining structural parameters:
  - 4 λ's estimate differences in initial belief of entrepreneurs vs. non-entrepreneurs in each period
  - 2 θ's estimate updates that drive switching
  - ρ and β are as in preferred model

Back

Nested Models: DCRE

- 9 restrictions on full model: 7 of the λ's $= 0$, 1 of the θ's $= 0$ and $\phi = 0$
- 8 remaining structural parameters:
  - 4 λ's estimate differences in initial belief of entrepreneurs vs. non-entrepreneurs in each period
  - 2 θ's estimate updates that drive switching
  - ρ and β are as in preferred model

Back

Nested Models: CRE

- Homogeneous return with perfect information (HH FE)

$$y_{it} = \alpha_t + \beta D_{it} + \overbrace{\eta_i}^{\text{no shock } (\varepsilon_{it})} + \tau_i + \zeta_{it} \tag{31}$$

- η_i is known part of fixed effect that affects choices
- Histories still do not matter
- Single projection of η_i on sector and capital choices, no interactions

Back

Nested Models: CRE

- Homogeneous return with perfect information (HH FE)

$$y_{it} = \alpha_t + \beta D_{it} + \overbrace{\eta_i}^{\text{no shock } (\varepsilon_{it})} + \tau_i + \zeta_{it} \tag{31}$$

- η_i is known part of fixed effect that affects choices
- Histories still do not matter
- Single projection of η_i on sector and capital choices, no interactions

Back

Nested Models: CRE

- Homogeneous return with perfect information (HH FE)

$$y_{it} = \alpha_t + \beta D_{it} + \overbrace{\eta_i}^{\text{no shock } (\varepsilon_{it})} + \tau_i + \zeta_{it} \tag{31}$$

- η_i is known part of fixed effect that affects choices
- Histories still do not matter
- Single projection of η_i on sector and capital choices, no interactions

Back

Nested Models: CRE

- Homogeneous return with perfect information (HH FE)

$$y_{it} = \alpha_t + \beta D_{it} + \overbrace{\eta_i}^{\text{no shock } (\varepsilon_{it})} + \tau_i + \zeta_{it} \tag{31}$$

- η_i is known part of fixed effect that affects choices
- Histories still do not matter
- Single projection of η_i on sector and capital choices, no interactions

Back

Nested Models: CRE

- 11 restrictions on full model, combination of restrictions from CRC and DCRE
  - 3 θ's $= 0$
  - 7 of the λ's $= 0$
  - $\phi = 0$
- 4 remaining structural parameters:

Back

Nested Models: CRE

- 11 restrictions on full model, combination of restrictions from CRC and DCRE
  - 3 θ's $= 0$
  - 7 of the λ's $= 0$
  - $\phi = 0$
- 4 remaining structural parameters:

Back

Nested Models: CRE

- 11 restrictions on full model, combination of restrictions from CRC and DCRE
  - 3 θ's $= 0$
  - 7 of the λ's $= 0$
  - $\phi = 0$
- 4 remaining structural parameters:
  - 4 λ's
  - β is as in preferred model

Back

Nested Models: CRE

- 11 restrictions on full model, combination of restrictions from CRC and DCRE
  - 3 θ's $= 0$
  - 7 of the λ's $= 0$
  - $\phi = 0$
- 4 remaining structural parameters:
  - 4 λ's
  - β is as in preferred model

Back

Nested Models: CRE

- 11 restrictions on full model, combination of restrictions from CRC and DCRE
  - 3 θ's $= 0$
  - 7 of the λ's $= 0$
  - $\phi = 0$
- 4 remaining structural parameters:
  - 4 λ's
  - β is as in preferred model

Back

Nested Models: CRE

- 11 restrictions on full model, combination of restrictions from CRC and DCRE
  - 3 θ's $= 0$
  - 7 of the λ's $= 0$
  - $\phi = 0$
- 4 remaining structural parameters:
  - 4 λ's
  - β is as in preferred model

Back

Nested Models: CRE

- 11 restrictions on full model, combination of restrictions from CRC and DCRE
  - 3 θ's $= 0$
  - 7 of the λ's $= 0$
  - $\phi = 0$
- 4 remaining structural parameters:
  - 4 λ's
  - β is as in preferred model

Back

Summary Statistics

Count	1103	
	Mean	SD
Income		
ln(gross income), 2005	11.58	1.04
ln(gross income), 2008	11.84	1.03
Entrepreneurship		
Household Business, 2005	0.44	0.50
Household Business, 2008	0.47	0.50
Inputs		
ln(Total Expenditure), 2005	8.23	4.09
ln(Total Expenditure), 2008	8.16	4.50
Household Demographics, 2005		
Household Size	4.23	1.74
Average Age	37.64	13.20
Proportion Male	0.47	0.20
Proportion Completed Primary School	0.27	0.26

Summary Statistics

Count	364		156		123		460	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Income								
ln(gross income), 2005	11.99	1.08	11.42	0.90	11.85	0.91	11.23	0.96
ln(gross income), 2008	12.24	1.18	11.99	0.79	11.82	0.90	11.49	0.89
Inputs								
ln(Total Expenditure), 2005	10.44	2.19	8.09	3.74	9.97	2.38	6.07	4.57
ln(Total Expenditure), 2008	10.59	2.64	9.59	2.98	7.01	4.90	6.07	4.86
Household Demographics, 2005								
Household Size	4.36	1.60	4.49	1.70	4.30	1.72	4.02	1.85
Average Age	35.89	11.35	35.25	11.61	38.35	13.05	39.64	14.73
Proportion Male	0.48	0.18	0.49	0.18	0.47	0.20	0.46	0.23
Proportion Completed Primary School	0.32	0.26	0.28	0.25	0.27	0.25	0.23	0.25

Back

Summary Statistics

Count	364		156		123		460	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Savings								
Household Has Savings, 2005	0.87	0.34	0.74	0.44	0.86	0.35	0.68	0.47
Household Has Savings, 2008	0.90	0.30	0.86	0.35	0.88	0.33	0.76	0.43
Credit Constrained								
Expansion would be profitable, 2005	0.26	0.44	0.10	0.30	0.28	0.45	0.10	0.31
Expansion would be profitable, 2008	0.03	0.18	0.05	0.22	0.01	0.09	0.02	0.13
Borrowing								
Any Loans, 2005	0.90	0.31	0.82	0.38	0.83	0.38	0.71	0.45
Any Loans, 2008	0.87	0.34	0.83	0.37	0.78	0.42	0.67	0.47

Back

OLS

	Prices & Inputs	Inputs	No Covariates
Household Business	0.307***	0.245***	0.646***
	(0.0452)	(0.0467)	(0.0516)
ln(Input Expenditure)	0.106***	0.103***	
	(0.00640)	(0.00653)	
Observations	2,206	2,206	2,206
R-squared	0.432	0.239	0.095

Back

FE

	Prices & Inputs	Inputs	No Covariates
Household Business	0.178**	0.194**	0.332***
	(0.0797)	(0.0812)	(0.0804)
ln(Input Expenditure)	0.0675***	0.0646***	
	(0.0130)	(0.0130)	
Observations	2,206	2,206	2,206
R-squared	0.860	0.828	0.815

Back

MD (No Covariates)

	CRE	DCRE	CRC	DCRC
β	0.3044***	0.3064***	0.3436	0.3493
	(0.0546)	(0.0624)	(0.2050)	(0.2146)
ϕ			-0.1647	-0.1732
			(0.8056)	(0.8235)
χ^2	0.428	0.4238	0.0135	
df	3	2	1	0
obs	1103	1103	1103	1103
p-value	0.9344	0.809	0.9075	

Back

MD (Endogenous Capital with Prices)

	CRE	DCRE	CRC	DCRC
θ_2		0.0149		-0.7488
		(0.0683)		(0.7710)
θ_{k2}		-0.0002		-0.0050
		(0.0079)		(0.0090)
$\theta_{k2\text{-}2}$				0.0709
				(0.0677)

Back

MD (Endogenous Capital with Prices)

	CRE	DCRE	CRC	DCRC
λ_1	0.2099***	0.2133***	0.1465	0.1627
	(0.0484)	(0.0510)	(0.2425)	(0.2464)
λ_2	0.1396	0.1356**	-0.2109	-0.1345
	(0.0518)	(0.0545)	(.2433)	(0.2606)
λ_{12}			-2.1101**	-4.1961
			(1.0329)	(2.9516)

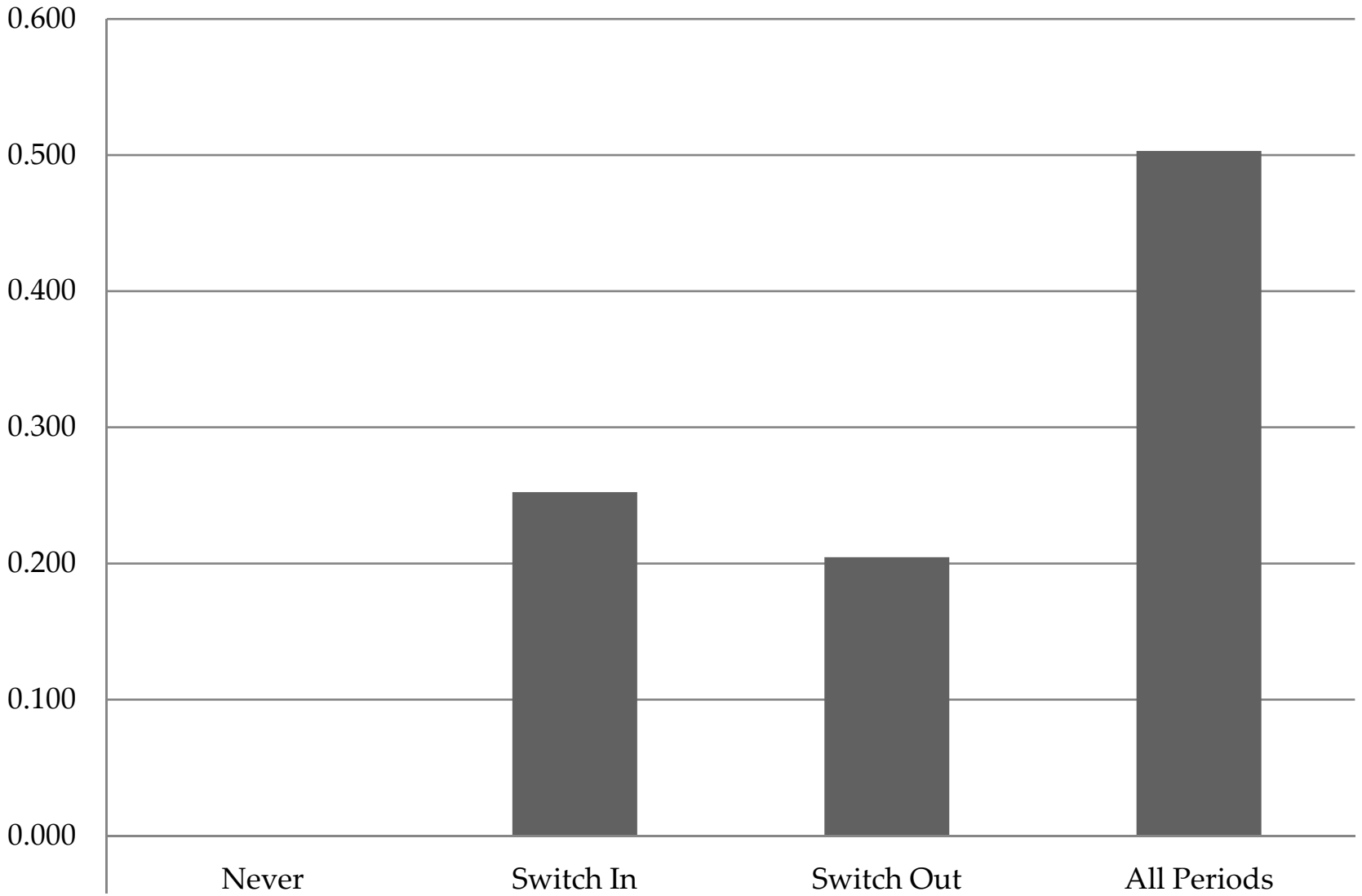
Back

MD (Endogenous Capital with Prices)

	CRE	DCRE	CRC	DCRC
λ_{k1}	0.0056	0.0055	0.0068	0.0050
	(0.0071)	(0.0072)	(0.0091)	(0.0096)
λ_{k2}	0.0231***	0.0231***	0.0133	0.0139
	(0.0077)	(0.0079)	(0.0096)	(0.0105)
$\lambda_{k1\text{-}1}$			0.0143	0.0137
			(0.0235)	(0.0247)
$\lambda_{k1\text{-}2}$			-0.0346**	-0.0453**
			(0.0168)	(0.0204)
$\lambda_{k1\text{-}12}$			0.1512**	0.2543
			(0.0739)	(0.1627)
$\lambda_{k2\text{-}1}$			-0.0130	-0.0123
			(0.0153)	(0.0171)
$\lambda_{k2\text{-}2}$			0.0603**	0.0601**
			(0.0253)	(0.0259)
$\lambda_{k2\text{-}12}$			0.0603	0.1715
			(0.0508)	(0.1585)

Back

Perceived Gains ($\beta + \phi\eta_i$)



▸ Projection Coefficients ▸ 3 period results

3 Period: Data

- Townsend Thai Project data from 2001, 2005 and 2009
- 4 provinces: 2 from rural Northeast region and 2 from urban Central region
  - 4 sub-regions randomly selected (tambons) from each province
  - 4 villages from each sub-region
  - 15 households from each village
- 2009 latest available wave

Back

3 Period: Data

- Townsend Thai Project data from 2001, 2005 and 2009
- 4 provinces: 2 from rural Northeast region and 2 from urban Central region
  - 4 sub-regions randomly selected (tambons) from each province
  - 4 villages from each sub-region
  - 15 households from each village
- 2009 latest available wave

Back

3 Period: Data

- Townsend Thai Project data from 2001, 2005 and 2009
- 4 provinces: 2 from rural Northeast region and 2 from urban Central region
  - 4 sub-regions randomly selected (tambons) from each province
  - 4 villages from each sub-region
  - 15 households from each village
- 2009 latest available wave

Back

3 Period: Data

- Townsend Thai Project data from 2001, 2005 and 2009
- 4 provinces: 2 from rural Northeast region and 2 from urban Central region
  - 4 sub-regions randomly selected (tambons) from each province
  - 4 villages from each sub-region
  - 15 households from each village
- 2009 latest available wave

Back

3 Period: Data

- Townsend Thai Project data from 2001, 2005 and 2009
- 4 provinces: 2 from rural Northeast region and 2 from urban Central region
  - 4 sub-regions randomly selected (tambons) from each province
  - 4 villages from each sub-region
  - 15 households from each village
- 2009 latest available wave

Back

3 Period: Data

- Balanced panel includes 794 households
- Information on income and expenditure in agriculture, wage labor, and entrepreneurship
- Information on savings, self-reported credit constraints, and expected incomes in good and bad states and on average
- Roughly 45% of households engage in entrepreneurship in each wave
- Roughly 49% switch sectors at least once

Back

3 Period: Data

- Balanced panel includes 794 households
- Information on income and expenditure in agriculture, wage labor, and entrepreneurship
- Information on savings, self-reported credit constraints, and expected incomes in good and bad states and on average
- Roughly 45% of households engage in entrepreneurship in each wave
- Roughly 49% switch sectors at least once

Back

3 Period: Data

- Balanced panel includes 794 households
- Information on income and expenditure in agriculture, wage labor, and entrepreneurship
- Information on savings, self-reported credit constraints, and expected incomes in good and bad states and on average
- Roughly 45% of households engage in entrepreneurship in each wave
- Roughly 49% switch sectors at least once

Back

3 Period: Data

- Balanced panel includes 794 households
- Information on income and expenditure in agriculture, wage labor, and entrepreneurship
- Information on savings, self-reported credit constraints, and expected incomes in good and bad states and on average
- Roughly 45% of households engage in entrepreneurship in each wave
- Roughly 49% switch sectors at least once

Back

3 Period: Data

- Balanced panel includes 794 households
- Information on income and expenditure in agriculture, wage labor, and entrepreneurship
- Information on savings, self-reported credit constraints, and expected incomes in good and bad states and on average
- Roughly 45% of households engage in entrepreneurship in each wave
- Roughly 49% switch sectors at least once

Back

3 Period: Summary Statistics

Count	794	
	Mean	SD
ln(gross income), 2001	11.365	1.080
ln(gross income), 2005	11.563	1.073
ln(gross income), 2009	11.951	1.037
Entrepreneurship		
Household Business, 2001	0.447	0.498
Household Business, 2005	0.485	0.500
Household Business, 2009	0.466	0.499
Inputs		
ln(Total Expenditure), 2001	8.710	3.671
ln(Total Expenditure), 2005	8.558	3.836
ln(Total Expenditure), 2009	8.119	4.692
Household Demographics, 2001		
Household Size	4.630	1.803
Average Age	35.076	11.515
Proportion Male	0.490	0.196
Proportion Completed Primary School	0.241	0.244

3 Period: Summary Statistics

	Mean	SD
Savings		
Household Has Savings, 2001	0.722	0.448
Household Has Savings, 2005	0.787	0.410
Household Has Savings, 2009	0.849	0.358
Financial Shocks		
Low Income Last Year, 2001	0.540	0.499
Low Income Last Year, 2005	0.492	0.500
Low Income Last Year, 2009	0.271	0.445
Credit Constrained		
Expansion would be profitable, 2001	0.283	0.451
Expansion would be profitable, 2005	0.180	0.385
Expansion would be profitable, 2009	0.006	0.079
Borrowing		
Any Loans, 2001	0.732	0.443
Any Loans, 2005	0.827	0.378
Any Loans, 2009	0.775	0.418

3 Period: OLS

	OLS			
	Prices, Inputs and Savings	Prices and Inputs	Village x Year Dummies (Prices)	No Covariates
Household Business	**0.344*** **	**0.346*** **	**0.792*** **	**0.766*** **
	(0.0372)	**(0.0377)**	**(0.0435)**	**(0.0429)**
ln(Input Expenditure)	0.106***	0.117***		
	(0.00769)	(0.00530)		
Saving	0.326***			
	(0.0852)			
ln(Input Expenditure) x Saving	0.00272			
	(0.00944)			

Back

3 Period: FE

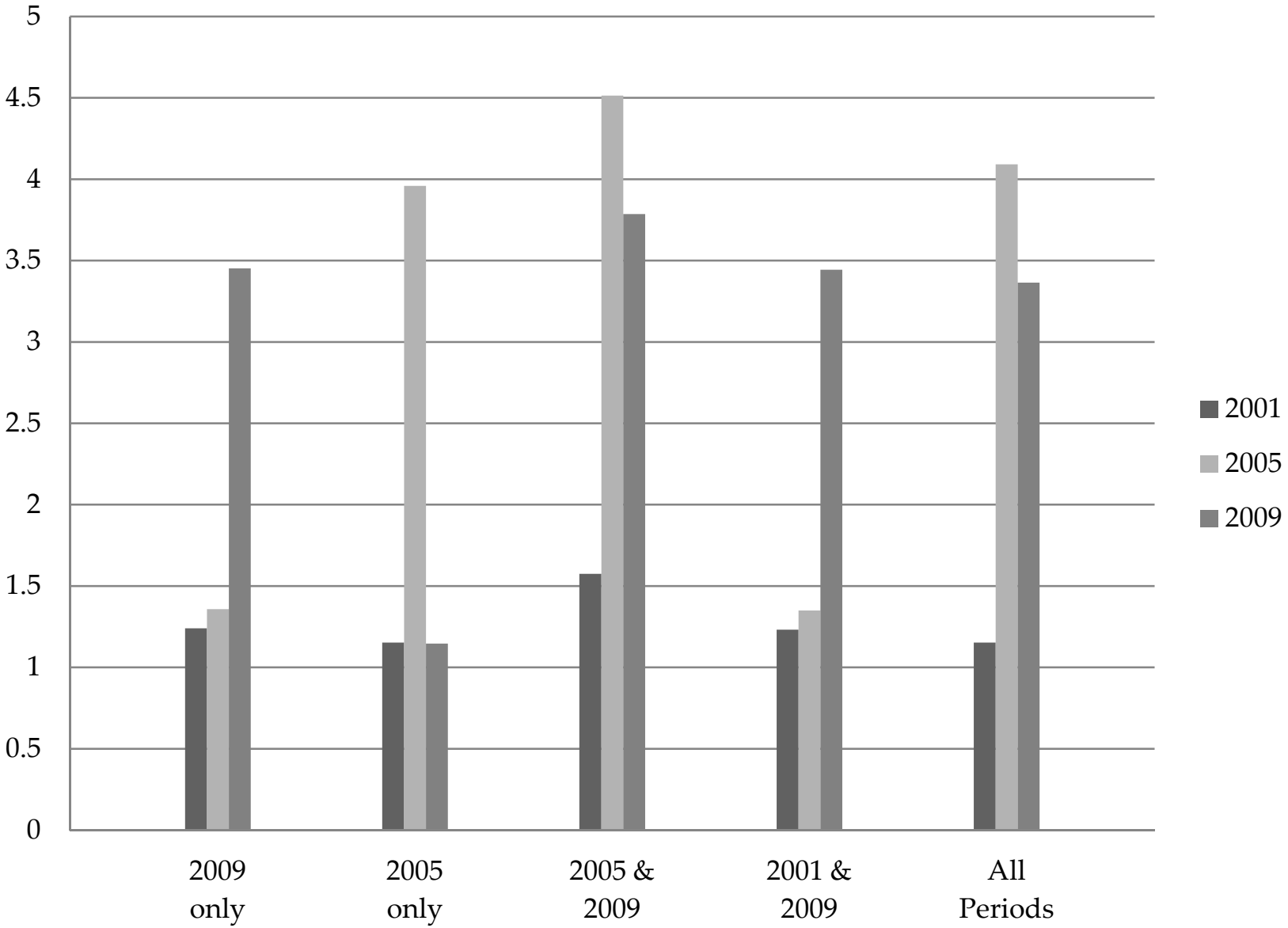
	FE			
	Prices, Inputs and Savings	Prices and Inputs	Village x Year Dummies (Prices)	No Covariates
Household Business	**0.223*** **	**0.225*** **	**0.369*** **	**0.368*** **
	(0.0526)	**(0.0528)**	**(0.0557)**	**(0.0547)**
ln(Input Expenditure)	0.0795***	0.0785***		
	(0.0127)	(0.00900)		
Saving	0.240**			
	(0.116)			
ln(Input Expenditure) x Saving	-0.00525			
	(0.0128)			

Back

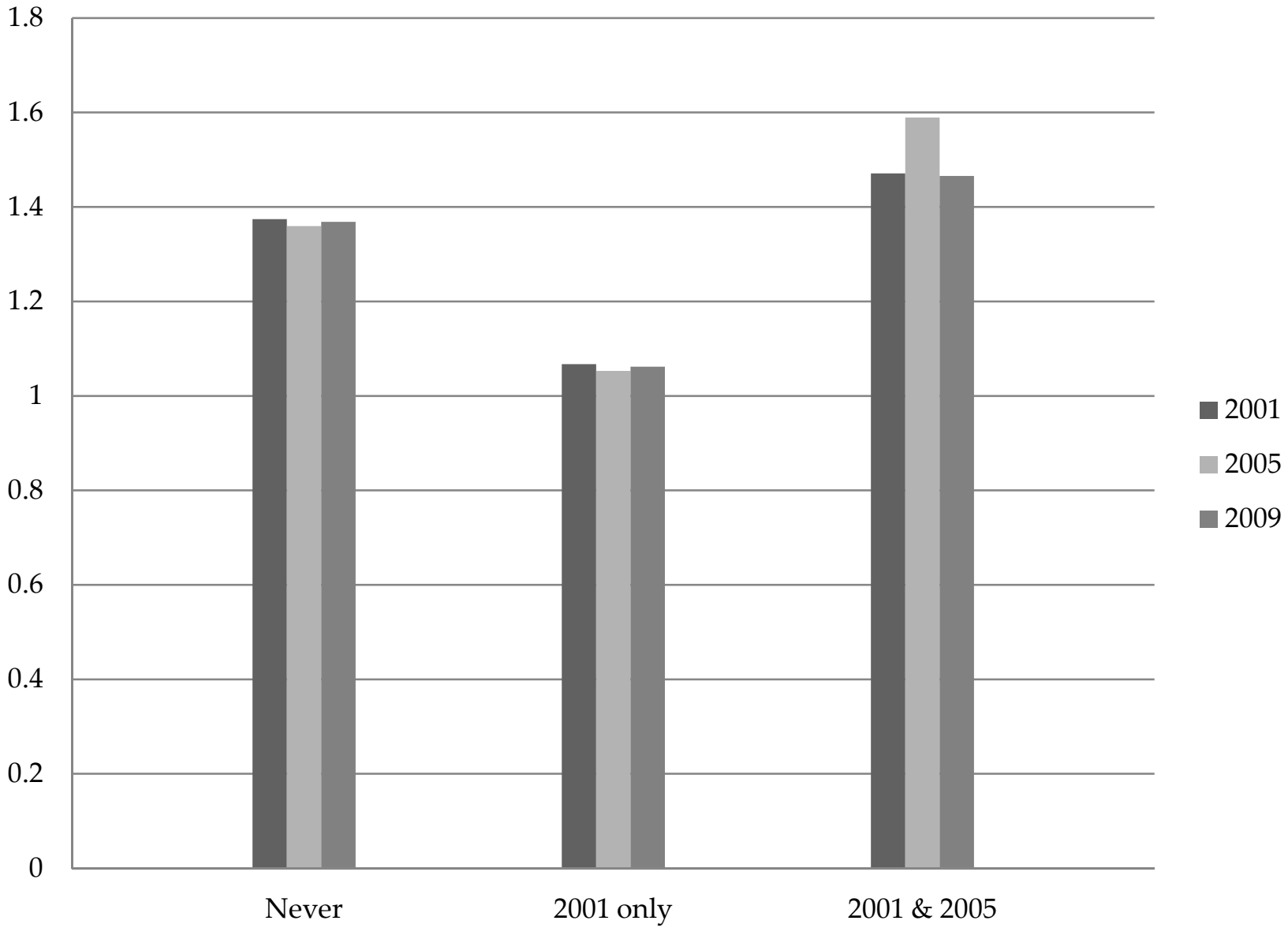
3 Period: MD (Price and Input Controls)

	CRE	CRC	DCRE	DCRC
β	0.4664	0.5428	1.278	1.3721
	(0.4882)	(0.4745)	(0.6285)	(0.6202)
ϕ		-0.3388		-0.6509
		(0.0927)		(0.1634)
χ^2	378.5737	465.467	6.68	12.1924
df	5	12	2	**9**
obs	794	794	794	794
p-value	0.0001	0.0001	0.0354	0.2027

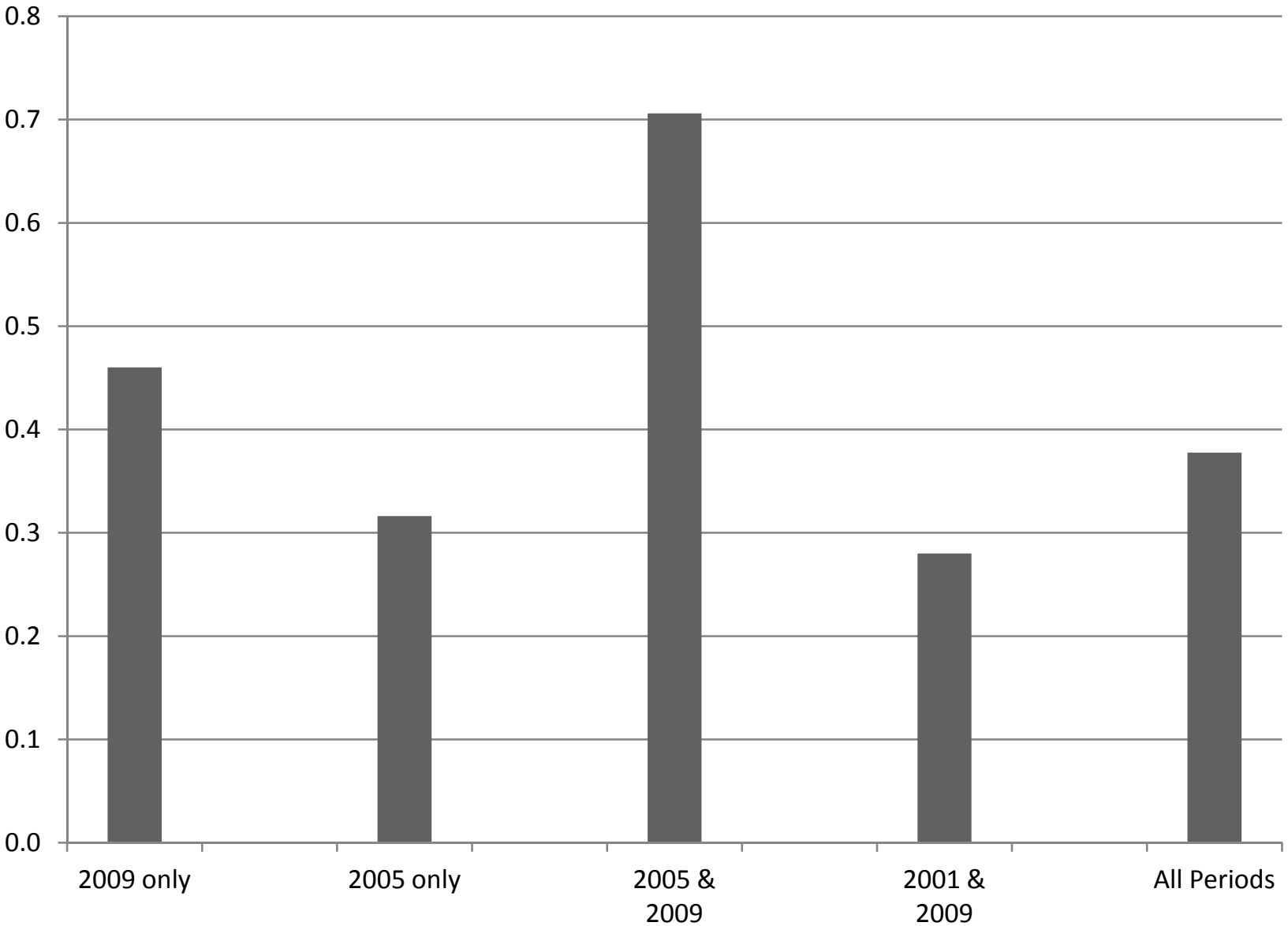
3 Period: Perceived Returns (DCRC)



3 Period: Perceived Returns (DCRC)



3 Period: Perceived Returns (CRC)



3 Period: Perceived Returns (CRC)