

# **A General Equilibrium Analysis of College Enrollment, Completion, and Labor Market Outcomes**

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# Motivation

- **Consider alternative mechanisms to provide student financial aid for higher education**
- **How do they affect aggregate human capital and labor market outcomes?**
- **We focus on Colombia – but relevant for other countries (including the US) as well**

# **Our research questions**

- **What are the patterns of college enrollment, academic progress, and completion in Colombia?**
  - Who enrolls in higher ed?
  - Who drops out?
  - Who goes on track / behind?
- **What explains these patterns?**
- **What if funding mechanisms change?**
- **What are the predicted long-run outcomes for the economy?**
  - Skills
  - inequality

# No straightforward answer

- **Feedback between higher ed and labor market**
  - More graduates → lower returns → less investment in higher ed
- **But increasing access may have other, unintended effects:**
  - Attract weak students
  - Extend time-to-degree
  - Raise dropout rate
  - Lower incentives to student effort
- **Final effect depends on selection, effort incentives, and general equilibrium feedbacks**

# Our Approach

- **General equilibrium model (DSGE model):**
  - College enrollment
  - Student effort choice
  - College academic progress and graduation
  - Labor market returns
- **Quantitative version for Colombia**
- **Simulate alternative funding mechanisms**
- **Predict long-run outcomes**

# Particularly important for Latin America

- **Gross enrollment rates: from 21 to 40% b/w 2000 and 2010.**
- **But only 14% of the WAP has completed higher ed**
  - 42% in the US
- **High returns to higher ed**
  - Mincer returns = 104% on average
- **Countries want to expand higher ed**
  - Free (or almost free) public colleges in several countries
  - Free college proposed in others
- **But low growth and tight fiscal constraints**
- **Critical to understand trade-offs**

# Higher education in Colombia

- **Representative of other HE systems in the region**
- **Third largest economy in Latin America**
- **Almost even share of public and private enrollment**
  - **Public system: highly subsidized**
  - **Recently: some credit and scholarships, mostly for private institutions**
- **Focus on bachelor's programs**
  - **80% of higher ed enrollment**
  - **Usually 5 years**

# Data

- **Universe of higher ed students (SPADIES)**
  - High school grads from 2005 (n=360,000)
  - For each student:
    - Score in mandatory high-school exit exam (ability measure)
    - Family income bracket at the end of high school
    - Full college trajectory
- **Household surveys**
  - Labor market outcomes by educational attainment



# Enrollment rates

Overall = 41%

Income bracket	Ability quintile					Total
	1	2	3	4	5	
5+ MW						77
3-5 MW						69
2-3 MW						53
1-2 MW						38
<1 MW						24
Total	20	27	36	49	71	41

14-28 28-42 42-56 56-70 70-86

# Dropout Rates

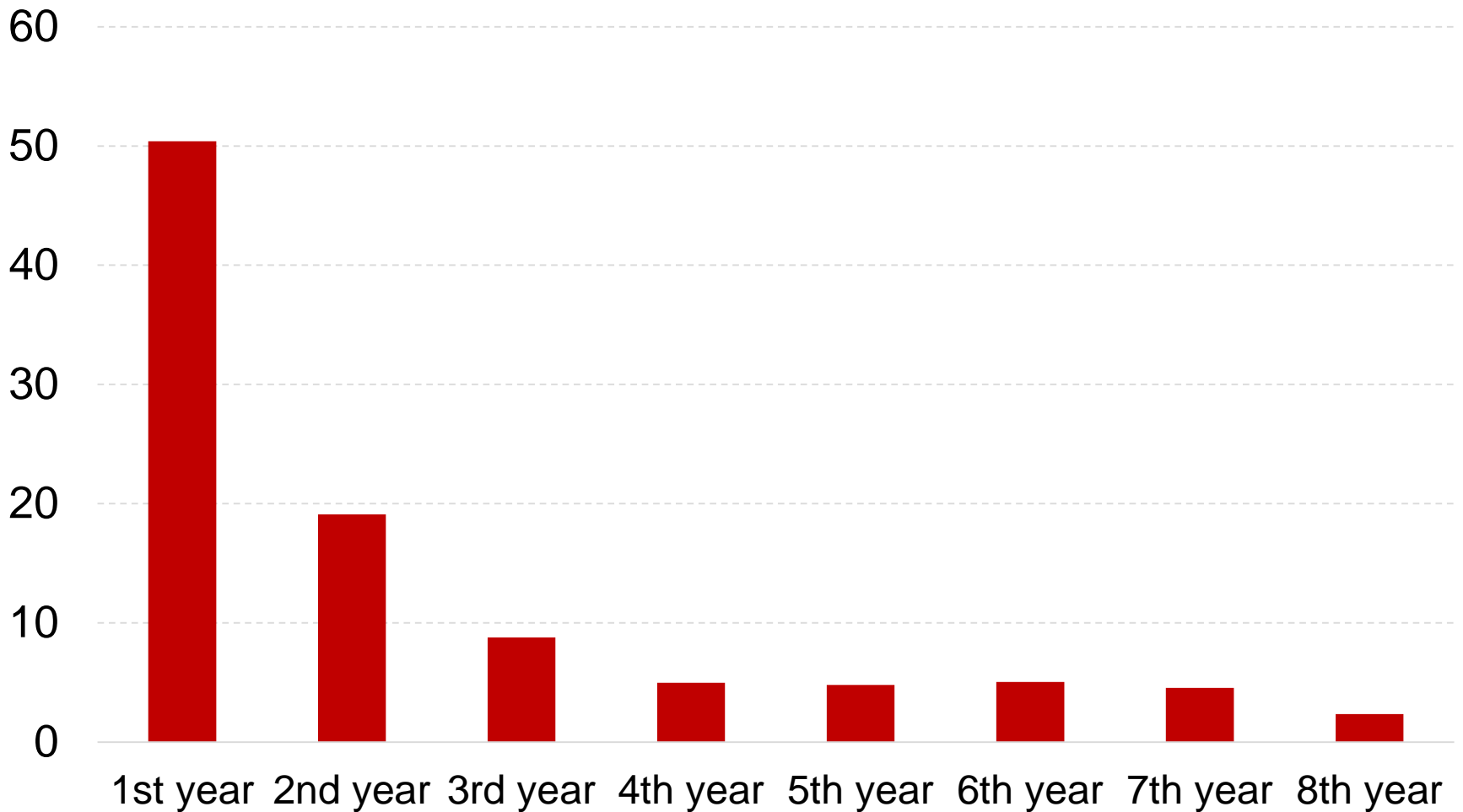
Overall = 54%

Income bracket	Ability quintile					Total
	1	2	3	4	5	
5+ MW						45
3-5 MW						51
2-3 MW						55
1-2 MW						58
<1 MW						59
Total	71	67	62	57	46	54

39-45 45-55 55-65 +65

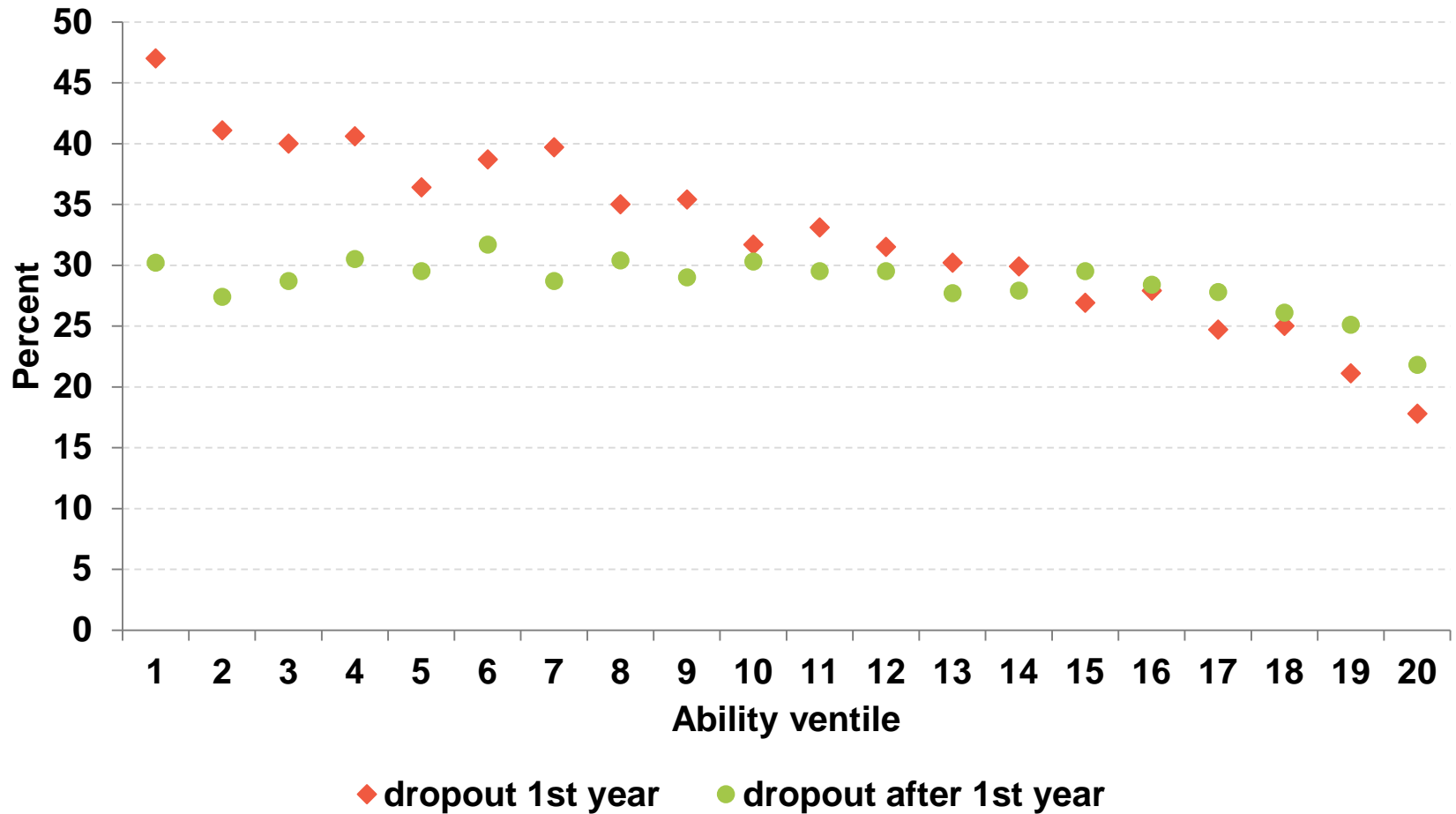
# Dropout timing

Distribution of dropouts by year



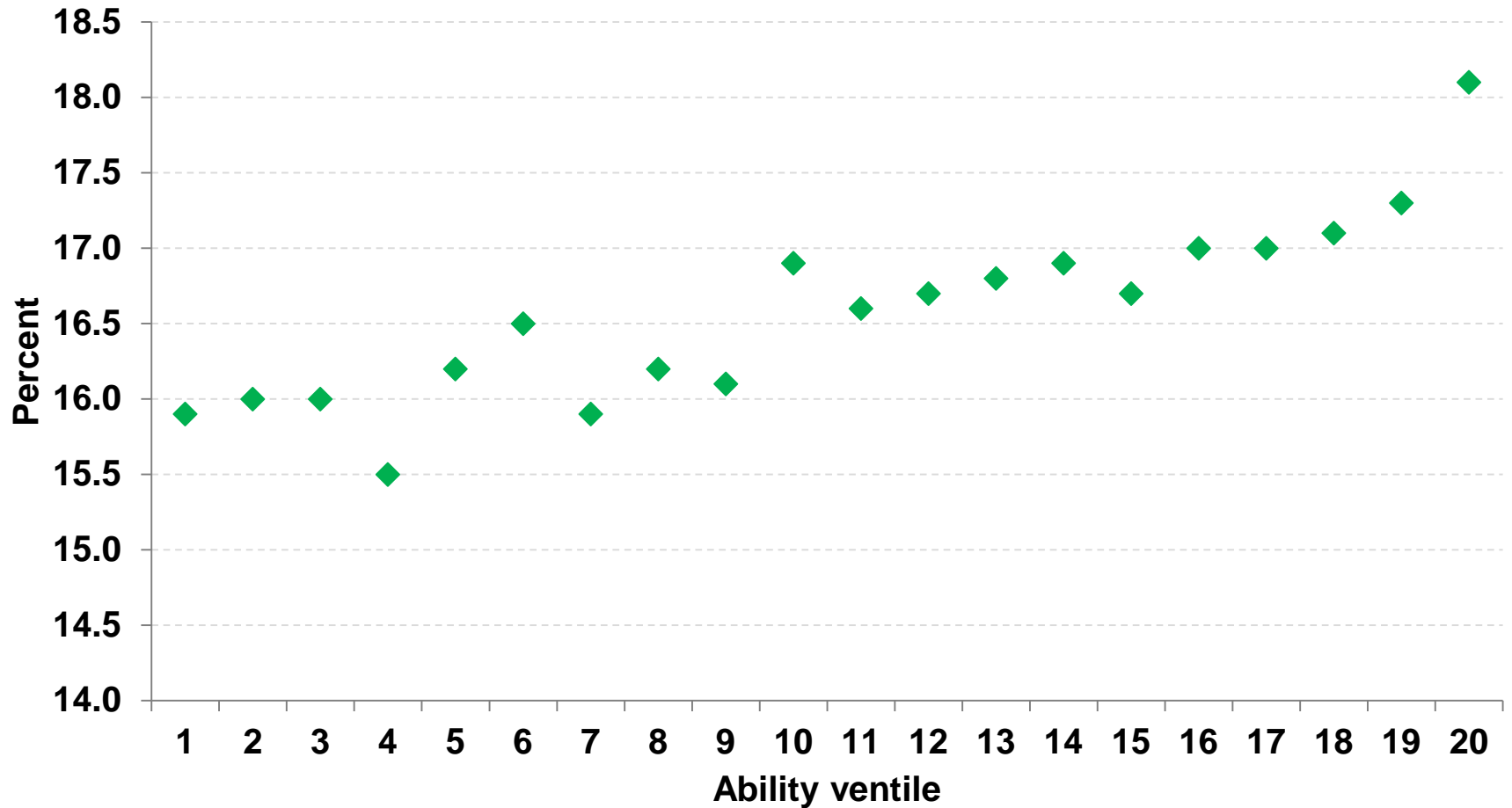
# Dropout timing, by ability

Probability of dropping out the first year,  
and after the first year (relative to entering cohort)



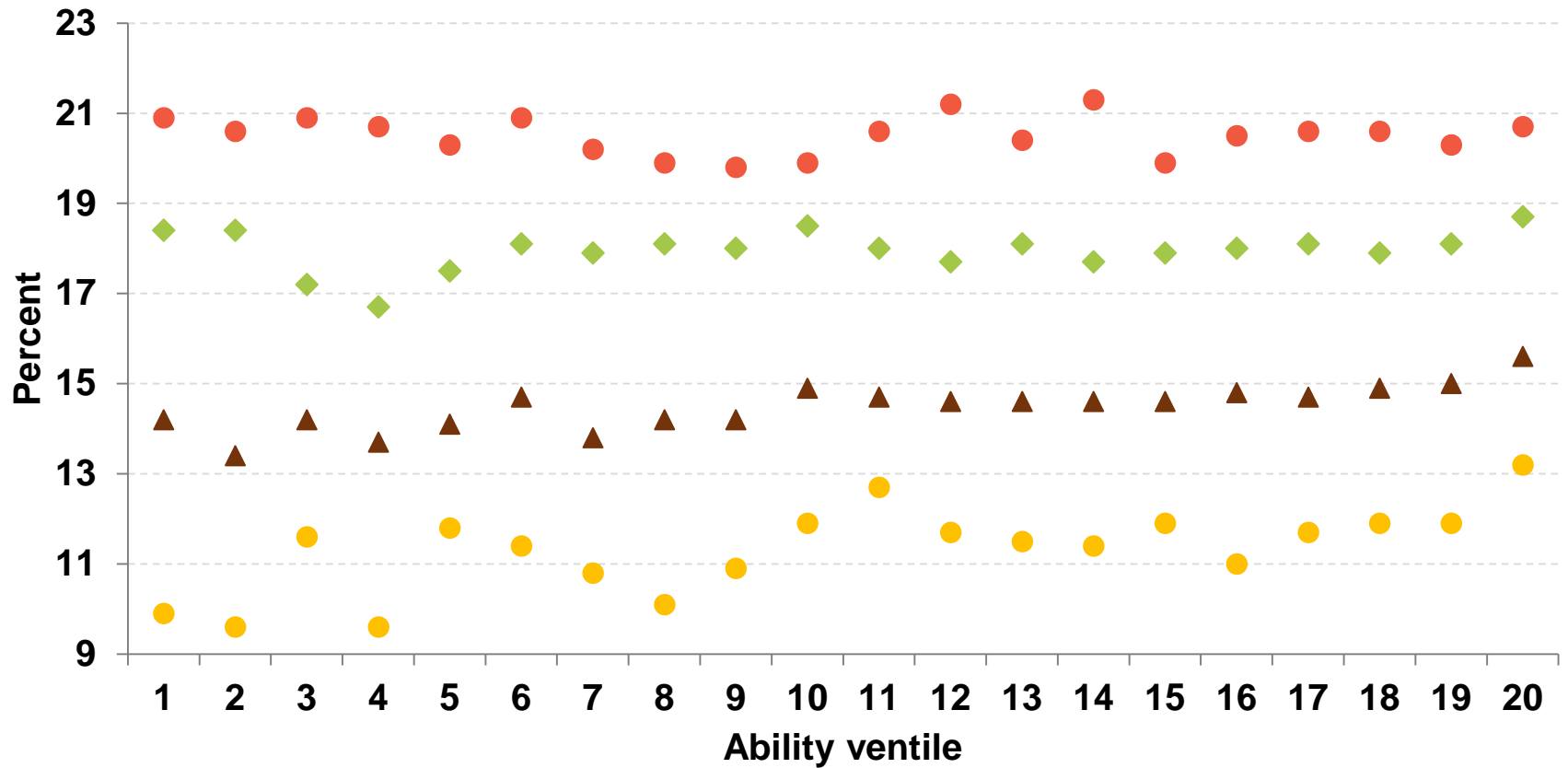
# Academic progress, by ability

Percent of required classes completed by the end of the first year  
(on-track students complete 20%)



# Academic progress (end of first year)

## Academic progression by end of year 1

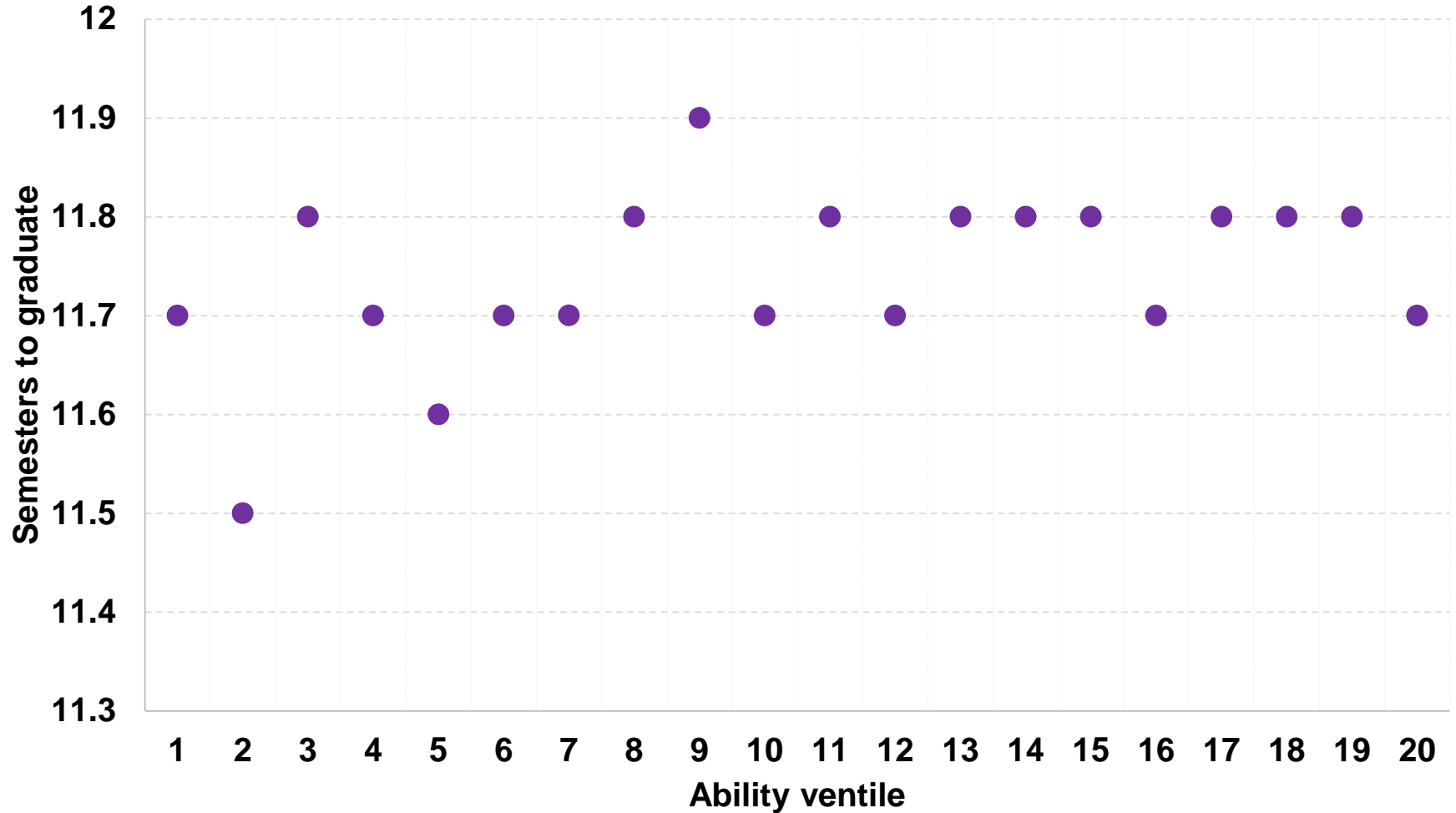


● On-time graduates    ◆ Late graduates    ▲ Dropouts (eventually)    ● Dropouts (this year)

# Time-to-Degree

Average = 11.8 semesters

Time to degree, by ability



# Model Features

- **Overlapping generations model**
- **High school graduates are heterogeneous by ability and parental transfers**
- **Higher education**
  - **Investment decision: multi-period, risky, lumpy**
  - **Endogenous decisions:**
    - **Enrollment**
    - **Drop out**
    - **Effort**
- **Aggregate education decisions affect:**
  - **labor market → endogenous returns to college**
  - **Aggregate output**



# College students

- **Must complete credit requirements to graduate**
  - **Minimum time-to-degree: 5 years**
  - **Maximum time-to-degree: 8 years**
- **May drop out and enter workforce at any time**
- **Can use time to study (e) or enjoy leisure (l)**
  - **Effort is costly**
- **Funding comes from parents, government grants, loans**

# College students (cont.)

- Percent credits completed at the end of a period:

$$h' = h + \kappa ((1+h)^*\theta)^\alpha e^{1-\alpha} \exp(z)$$

$\kappa$  = percent credits to be completed per year (usually 20%)

$e$  = effort

$\theta$  = ability

$z$  = idiosyncratic shock (per student and period) → not known at the beginning of the period

- At the beginning of each period, compute the expected value of:
  - Staying in college (given optimal effort)
  - Dropping out and entering the workforce
- At the end of the 8<sup>th</sup> year, either graduate or drop out

# Workers

- **Standard life-cycle optimization problem**
  - **Choose consumption and leisure**
- **Workers differ in their life-time income**
  - **Function of education level (and how long it took them to attain it)**

# Model (cont.)

- **High school graduate chooses college if:**
  - **Expected value of college > expected value of high school**
- **Expected value of college depends on:**
  - **Ability**
  - **Parental transfers**
  - **Financial aid**
  - **Expected shocks**
  - **Expected returns**

# Labor market

- **Firms' technology**

$$Y=F(K,N)$$

**K= capital**

**N = labor → high school (H) and college (G) graduates**

- **Wages vary by skill (H, G, and college dropouts) and experience**

# Simulating Funding Policies

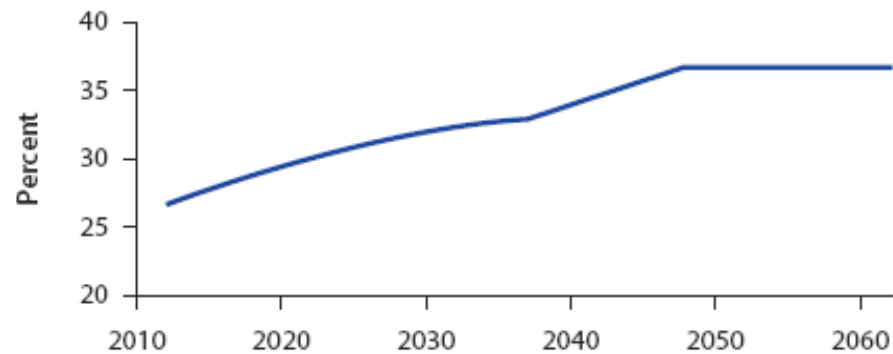
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	<b>Data</b>	<b>Baseline</b>	<b>Free Tuition</b>	<b>High Tuition Cost</b>
Enrollment	40.6%	41.41%	41.41%	35.49%
Dropout	54.4%	55.96%	55.97%	56.18%

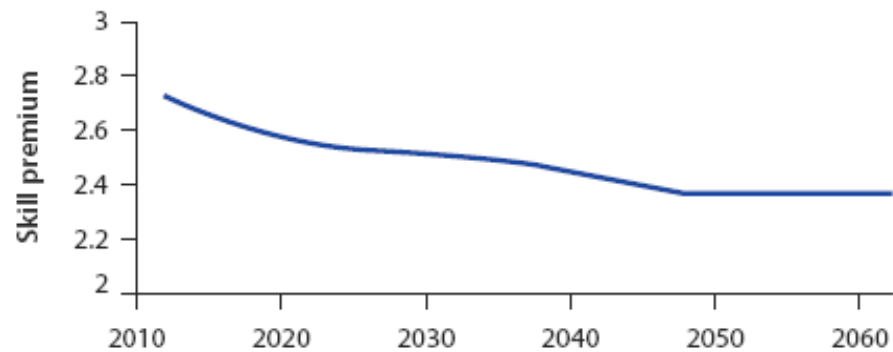
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# Long-run effects: increasing number of graduates by 50%

a. Share of college graduates  
in the labor force, Colombia



c. Colombia



# Conclusions

- **Higher ed finance may have unintended consequences**
  - Selection into higher ed
  - Incentives for student effort
  - Greater supply of college-educated students
- **Be sober about long run effects**
- **May need other reforms:**
  - Shorten programs
  - General education requirements
  - Student advising
  - Remedial education
  - Non-financial supports