Ethnic Divisions and Production in Firms

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IGC Growth Week, Sept. 2012
Motivation

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- Possibility of additional *direct* effect on productivity in the **private sector** long recognized (communication, complementarity, discrimination, etc).

- But evidence from poor countries largely absent
This paper: exploit unusual high-frequency individual- and team-level production data to present the first causal evidence on

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1. The direct effect of the ethnic diversity in a poor country’s workforce on productivity
2. The primary source of the effect
3. How firms respond and their ability to limit the impact on output
4. How and why the magnitude of the effect varies within societies of a given level of ethnic heterogeneity
Case study: flower-packing plant in Kenya
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Team production in triangular packing units. One upstream “supplier” supplies two downstream “processors” who finalize observed output:
Figure 1: Organization of team production

Input flowers

Supplier

Processor 1

Output processor 1

Processor 2

Output processor 2
Figure 2: Team ethnicity configuration categories

- **Homogenous teams**
  - K
  - K
  - L
  - L

- **Horizontally mixed teams**
  - K
  - K
  - L
  - L
  - L
  - K

- **Vertically mixed teams**
  - K
  - L
  - L
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Show that plant’s position-and-team rotation system leads to quasi-random variation in team composition
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- Supplier influences processors’ pay
- Inefficient behavior costly to the supplier
1. Present model in which suppliers with a *taste for ethnic discrimination* distort supply of intermediate flowers. Predict
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   a. **processor output** higher when working with a *coethnic* supplier, and/or with a *non-coethnic* other processor
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   b. **team output** lower in mixed teams

2. Test model’s predictions by comparing homogeneous, horizontally mixed and vertically mixed teams

3. Estimate how magnitude of effect varies with relations between groups. Starting Dec 2007: period of heightened (political and violent) conflict in Kenya between the two ethnic groups

4. Explore ...firm’s response and ability to limit impact on output. Starting Feb 2008: team pay for processors introduced (piece rate for combined output)

5. Distinguish taste-based discrimination from other diversity effects. Model predicts (i) differential # in (horizontally and vertically) mixed teams’ output during conflict period, and (ii) differential " or smaller # in horizontally mixed teams’ output during team pay period
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5. *Distinguish taste-based discrimination from other diversity effects*. Model predicts (i) differential ↓ in (horizontally and vertically) mixed teams’ output during conflict period, and (ii) differential ↑ (or smaller ↓) in horizontally mixed teams’ output during team pay period
Preview of results

Figure 2: Output in homogeneous and mixed teams across time

Average number of roses produced

- Homogeneous teams
- Horizontally mixed teams
- Vertically mixed teams

2007
Dec. 27 2007 Election day Conflict begins
February 11 Team pay introduced
2008
2.1 The Setting: Kenya: ethnic diversity and floriculture

- Ethnic divisions influencing Kenyan society and politics since independence
  - The Kikuyu the most economically and politically influential tribe. President a Kikuyu since 2002
  - Opposition led by the Luo. Most tribes (politically and “socially”) aligned with one of the two associated camps → categorize a worker according to the tribal coalition (“ethnic group”) to which her tribe belongs (Kikuyu vs Luo)

- Interesting case-study in context of ethnic divisions: floriculture sector
  - Important sector in Kenya: supplies 31% of flowers imported into Europe, employs 50,000 + 500,000 in associated industries
  - Study one large farm, in ethnically mixed area
  - Greenhouse and packhouse (“plant”) work. Focus on plant workers: productivity measurable

- Data sources
  - 2007 and 2008 records of daily output for all packhouse workers, recorded by the plant for pay purposes
  - Survey of workers’ ethnicity, gender, etc:
2.2 The Setting: Organization of production

- Pay system

Supplier: piece rate per rose 
Processor: piece rate per rose 
Team rotation: Workers rotate teams over time. Almost all workers observed in both positions. Assignment to teams shown to be quasi-random.
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- **Pay system**
  - Supplier: piece rate $w$ per rose finalized by team. Processor: piece rate $2w$ per rose finalized by self
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- In paper, theoretical framework in which suppliers may have "taste for discrimination" - attach lower weight to non-coethnic processors’ output. Key predictions include:

- Pre-conflict period:
  - Suppliers misallocate flowers "vertically" (undersupplying downstream non-coethnics) and "horizontally" (shifting flowers from non-coethnics to coethnics) so that output is lower in mixed teams

- Conflict period:
  - If taste for discrimination increases during conflict, output in mixed teams falls

- Team pay period
  - Supplier’s incentive for horizontal misallocation eliminated. Output in horizontally mixed teams goes up (relative to other teams)
4.1 Empirical Results: Pre-conflict period: the effect of ethnic diversity on productivity
Figure 5: Output by team ethnicity configuration

95% confidence intervals are depicted. In teams with Kikuyu suppliers, average output in teams of different ethnicity configurations is as follows (standard errors in parenthesis). Team output in homogeneous teams: 6586 (12). Processor output in homogeneous teams: 5296 (8). Team output in horizontally mixed teams: 6307 (9). Processor output in horizontally mixed teams, supplier's coethnic: 3539 (8). Processor output in horizontally mixed teams, supplier's non-coethnic: 2777 (7). Team output in vertically mixed teams: 6073 (11). Processor output in vertically mixed teams: 3639 (7). In teams with Luo suppliers, average output in teams of different ethnicity configurations is as follows (standard errors in parenthesis). Team output in homogeneous teams: 6006 (12). Processor output in homogeneous teams: 3304 (6). Team output in horizontally mixed teams: 6250 (7).
4.2 Empirical Results: Conflict period: groups’ relations and the effect of ethnic diversity on productivity

- Dec 27 2007 election pitched the two ethnic blocs against each other
- Announced victory for incumbent Kikuyu leader Mwai Kibaki disputed. National political crisis and violence in some areas erupted
- Crisis ebbed after power-sharing agreement on April 3, 2008. By then 1,200+ killed and 500,000+ displaced (Gibson and Long, 2009)
- Location of plant less affected by violence

- Change in output in homogeneous teams will reflect (at least):
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  - homogeneous and mixed teams
  - coethnic processors in horizontally mixed vs homogeneous teams
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- Homogeneous teams
- Horizontally mixed teams
- Vertically mixed teams

Legend:
- Blue line: Homogeneous teams
- Red dashed line: Horizontally mixed teams
- Green dashed line: Vertically mixed teams
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- To test, consider period after change in pay system a single team pay period
Figure 8: Output by team ethnicity configuration
Before and after conflict, and under team pay

95% confidence intervals are depicted but narrow and thus hard to see. 'Conflict' signifies the first 6 weeks of 2008 when ethnically-based violence was taking place but processes were still paid individual rates. 'Team pay' signifies the remainder.

Team output
Processor output
Processor output, supplier's coethnic
Processor output, supplier's non-coethnic

Average number of roses produced
0  1400  2800  4200  5600  7000
No Conflict Team pay  No conflict Conflict Team pay  No conflict Conflict Team pay
Homogeneous Horizontally mixed Vertically mixed
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- *Taste* for discrimination likely to affect allocative efficiency also in broader economy (across firms? In public investment?)
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In combination, evidence from pre-conflict, conflict and team pay periods suggests non-taste-based explanation for lower output in mixed teams unlikely
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Analysis also points to a “hidden” effect of conflict episodes with real and potentially large economic costs: greater taste for ethnic discrimination. Especially among younger workers and those more personally affected by the conflict
Conclusion

Production data from teams of Kenyan factory workers indicate that ethnic diversity in workforce leads to misallocation within the firm and thereby lowers output.

One of several reasons why some diverse societies are more productive than others (form of production, e.g. degree of specialization / # of linkages, etc will also matter)

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- (At least part of the) reason is that workers have taste for ethnic discrimination. May contribute to misallocation also in broader economy: significant aggregate effects “could easily result from the manner in which individual tastes for discrimination allocate resources within a free-enterprise framework” (Becker, 1957).
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Thanks!