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**Fields of Concentration:**

Development Economics  
Labor Economics  
Applied Econometrics

**Desired Teaching:**

Development Economics  
Labor Economics  
Environmental Economics

**Comprehensive Examinations Completed:**

2005 (Oral): Development Economics, Labor Economics  
2004 (Written): Microeconomic Theory, Macroeconomic Theory

**Dissertation Title:**

*Groundwater Resources and Rural Livelihoods: Distributional Impacts of Industrial Water Demand*

**Committee:**

Professor Mark Rosenzweig  
Professor Christopher Udry  
Professor Ahmed Mushfiq Mobarak

**Expected Completion Date:** May 2009

**Degrees:**

Ph.D., Economics, Yale University, expected May 2009  
M.Phil., Economics, Yale University, December 2006  
M.A., Economics, Yale University, May 2005  
B.A., Economics, *summa cum laude*, Bilkent University, May 2003

**Fellowships, Honors and Awards:**

Yale University Dissertation Fellowship, Fall 2008  
 John F. Enders Fund, Graduate School of Arts and Sciences, Yale University, Summer 2007  
 Ryoichi Sasakawa Fellowship, 2006-2007  
 Yale University Economic Growth Center Field Research Prize, Fall 2006  
 Summer Fellowship, Yale University, 2004, 2005 and 2006  
 Yale University, Doctoral Fellowship, 2003-2007  
 Merit Scholarship (tuition&expenses), Bilkent University

**Teaching Experience:***Teaching Assistant:*

Introduction to Macroeconomics (undergraduate), Yale University, Scheduled Spring 2009  
 Development for IDE (graduate), Yale University, Spring 2008  
 Microeconomics with Environmental Applications (undergraduate), Yale University, Fall 2007  
 Introduction to Finance, Yale University Summer School, 2006 and 2007

*Instructor:*

Introduction to Stata, Centre for Micro Finance, IFMR, December 2006

**Research and Field Experience:**

Dissertation *Field Research*, Tamil Nadu, India, November 2006-December 2006  
 Collaborated with The Institute for Financial Management and Research (IFMR) to design the questionnaires for the first round of Tamil Nadu Mobility and Development Survey, conducted by Yale University  
*Research Assistant*, Rohini Pande, Yale University, 2004-2005  
*Research Assistant*, Christopher Udry, Yale University, Summer 2005  
*Research Assistant*, Economic Growth Center, Yale University, 2005-2006  
*Research Assistant*, Gustav Ranis, Yale University, 2006-present  
*Research Intern*, Central Bank of the Republic of Turkey, Department of Research, Summer 2002

**Papers:**

“Thirsty Factories, Hungry Farmers: Intersectoral Impacts of Industrial Water Demand” [Job Market Paper]  
 “Groundwater Scarcity and Female Labor Force Participation” (in progress)  
 “Modelling Optimal Firm Ownership Arrangement in a Transition Economy”, *mimeo*, May 2006

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**References:**

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## **Dissertation Abstract**

In the last three decades, groundwater depletion has emerged as a major consequence of the ever increasing population pressure, intensity of agricultural production and industrialization of developing countries. What is the role of industrialization in affecting groundwater resources? Does the depletion of groundwater levels affect the choice of crops to be cultivated? Are there any trade offs between growth, equity, and agricultural sustainability? My dissertation examines how groundwater scarcity, as caused by rising industrial demand, affects a country's ability to achieve food security and becomes an important determinant of gender inequality.

### **I. Thirsty Factories, Hungry Farmers: Intersectoral Impacts of Industrial Water Demand [Job Market Paper]**

Developing countries, governments, and international organizations have been promoting industrialization as a necessary component of the structural change that is part of economic development. However, many scholars have concerns about the sustainability of industrialization. The economic literature has so far focused on input-output linkages and labor movements as the two primary mechanisms through which industrialization and industrial policies (such as trade policies and anti-trust law) can affect the agricultural sector. I examine a natural resource link between industry and agriculture, both theoretically and empirically. In particular, I introduce water as an additional channel through which industrial policies affect agricultural production decisions. I show that industrialization may even hurt economic productivity since farmers compete with industry for an important resource - water.

Besides being used for agricultural production, water is an important input for many industrial processes. Industrial water uses range from fabricating, processing, washing, diluting, and incorporating water into a product to sanitation needs within the manufacturing facility itself. While some industries such as textiles and paper products use large amounts of water to produce commodities, others utilize only negligible amounts. Thus, the specific industrial composition of a region affects the strength of the water linkage introduced in this paper. In order to identify the effects of industrial composition in a region, I utilize the exogenous variation stemming from changes in trade policy coupled with regional variation in the water intensity of local industrial composition as an empirical instrument. I examine whether agricultural production decisions are affected by the changes in the industrial composition in the regions which make them more exposed to water demanding industrial activities.

To highlight the mechanisms through which the water link operates, I develop a three sector general equilibrium model in which agriculture and two different industries compete for a common input (water), while utilizing capital, labor and land as additional production resources. My model identifies two mechanisms through which the trade policy change could have effects on agricultural resource allocation. First, a decrease in the overall tariff protection level in the economy could drive the average wage rate down in the economy. Second, by changing the relative output prices of water intensive and non water intensive industries, trade reform could modify the industrial composition in the districts. This change may increase the pressure on groundwater resources and the unit price of water extraction. This, in turn, reduces the profitability of growing water intensive crops.

Using district-level data from India between 1993 and 1999, I quantify the effect of groundwater depletion. I show that this effect can aggravate the reduction in the water intensive crop production. In particular, I show that the trade liberalization in India in the early 1990s affected profit levels in water intensive and non water intensive industries differently. This caused a movement of labor between industries and a change in the industrial composition of each district. This shift, especially into water intensive industries, increased the pressure on groundwater resources. Since agriculture and industry compete for groundwater, the impacts of a supposedly one-sector policy diffused intersectorally. In particular, the empirical results of my study show that districts facing a more severe reduction in the

protection levels of non water intensive industries, relative to the water intensive ones, also experienced a shift of workers out of the non water intensive industrial sectors and a significant drop in groundwater levels combined with a decrease in the average manufacturing wages. My results also indicate that these districts suffered from a significant decrease in the water intensive crop production, such as rice and cotton. However, at the same time, I find no evidence of an increase in the area devoted to non water intensive crop production such as pulses or millet. Overall, the empirical evidence presented in this paper suggests that when evaluating the general equilibrium impacts of industrial policies, indirect effects, such as those operating through natural resources, must be taken into account. Indeed, these indirect effects of macro policies may well influence the rural and urban livelihoods.

## **II. Groundwater Scarcity and Female Labor Force Participation**

Underrepresentation of women in market-oriented activities is a widely discussed policy issue both in developing and developed countries. The high time cost of unpaid housework is argued to be one of the potential explanations for gender differentials in labor force participation. In many developing countries, women spend several hours everyday in the collection of natural resources, such as drinking water. In particular, over 69% of rural Indian households had to collect water for drinking water purposes in 1999. The data also suggests that those fetching water were predominantly women; and that on average, these people spent the equivalent of approximately one working day per week in water collection.

In this paper, I propose a simple theoretical model of female labor market participation decision under groundwater scarcity that implies a simple empirical test to determine whether groundwater scarcity decreases the productivity of time spent on home production of water and forces women to divert time from income earning market activities. Thus, in an analysis that complements my previous study, this paper provides insights into the micro level consequences of the groundwater depletion using India Rural Economic and Demographic Survey from 1999.

Using propensity score matching methods, I find that female labor force participation in families which use groundwater resources for drinking purposes is not significantly different from that of observationally equivalent households which use other sources of drinking water. However, the results also reveal that increasing groundwater scarcity makes groundwater-using women spend significantly more time fetching water everyday and influences the choices of hours spent in paid and unpaid jobs. In particular, in water scarce regions, women spend less time on wage earning activities and more in family farms and small-businesses.