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Poole, Jennifer Pamela

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UNIVERSITY OF CALIFORNIA, SAN DIEGO

Mobility and Information Flows in International Trade and Investment

A dissertation submitted in partial satisfaction of the
requirements for the degree
Doctor of Philosophy

in

Economics

by

Jennifer Pamela Poole

Committee in charge:

Professor James E. Rauch, Chair
Professor Eli Berman
Professor Gordon H. Hanson
Professor Craig McIntosh
Professor Marc-Andreas Muendler

2007

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The dissertation of Jennifer Pamela Poole is approved, and it is acceptable in quality and form for publication on microfilm:

Chair

University of California, San Diego

2007

To my grandmother
Victoria Neu
and
in memory of my grandfather
Robert Bernard Neu, M.D.

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VITA

1998	B. A., Smith College
1998-2001	Assistant Economist, Federal Reserve Bank of New York
2002-2007	Teaching Assistant, University of California, San Diego
2003-2006	Research Assistant, University of California, San Diego
2005	C. Phil., University of California, San Diego
2007	Ph. D., University of California, San Diego

ABSTRACT OF THE DISSERTATION

Mobility and Information Flows in International Trade and Investment

by

Jennifer Pamela Poole

Doctor of Philosophy in Economics

University of California San Diego, 2007

Professor James E. Rauch, Chair

This dissertation contains three self-contained chapters on international trade, labor, and development economics, with a special emphasis on Brazil. In particular, I investigate how worker mobility and individual interactions help to transfer information in an economy. Using new and little-explored data, I consider two broad topics related to globalization: how knowledge spillovers result from international integration and how networks of individuals create trade. In a third chapter, I explore how globalization contributes to interstate worker mobility in Brazil.

Labor turnover is a commonly-cited mechanism for the transmission of spillovers from multinational to domestic firms, but until now there has been little direct evidence for this mechanism. In the first chapter, using a novel matched establishment-worker database from Brazil, I present evidence consistent with the existence of positive multinational spillovers through worker mobility in Brazil. The main results suggest that the magnitude of wage spillovers from multinational establishments depends on the sector and worker under consideration. The results are consistent with the hypothesis that higher-skilled former multinational-establishment workers are better able to convey information and higher-skilled incumbent domestic workers are better able to absorb information.

The importance of business and social networks in generating trade is becoming increasingly recognized in the international economics literature. An important way in which people build and maintain networks is through face-to-face meetings. In the sec-

ond chapter, I propose an empirical model in which there exists a fixed cost to entering a new country market. The fixed cost, in the form of prior business travel, generates international export sales. The empirical evidence, using a unique survey of all outbound travelers from the U.S. on international flights, which differentiates between business and leisure travel and export volumes and varieties, supports the model. Lagged business travel from the United States has a positive effect on export varieties from the United States. The effect is driven by travel to non-English speaking countries, for which communication with the U.S. by other means may be less effective. Moreover, the effect is stronger for higher-skilled travelers, reflecting an enhanced ability to transfer information about trading opportunities.

In the third chapter, I use a unique linked employer-employee database to study the relationship between globalization and formal-sector interstate migration in Brazil, and pay special attention to the self-selection bias associated with the migration decision. I follow Dahl (2002) and estimate the worker's multi-choice migration problem. In the absence of employer-level information on foreign ownership and exporting status, state-level covariates would exhibit considerable omitted variable bias. The results provide support for the idea that globalization acts on internal migration through the growth of employment opportunities at locations with a high concentration of foreign-owned establishments and the stability of employment at exporting establishments.

1

Multinational Spillovers through Worker Turnover

1.1 Introduction

Despite the long history of academic work testing the implications from increased multinational presence on domestic firms, the exact mechanisms through which spillovers occur are rarely tested. Within the few studies that do address a particular mechanism of transmission, the existing empirical evidence on spillovers through worker turnover is limited, even though many multinational establishments devote a great deal of effort to retaining workers they train with valuable technological capital. In this chapter, I present evidence consistent with this single mechanism for spillovers from multinational establishments locating in Brazil. More precisely, I investigate multinational spillovers resulting from worker mobility. This chapter also explores *where* spillovers occur and *how* spillovers are absorbed. I discern the spillover effect by sector, and distinguish it by the skill-level of the displaced former multinational-establishment worker and the incumbent domestic worker.

Multinational enterprises (MNE) may instill positive technological knowledge on workers at their subsidiaries through labor training regarding new process innovations, high-quality intermediate inputs, and management styles. This imported technology, however, is a public good and knowledge transfer to local firms may occur as domes-

tic firms find out about the multinational's technology and attempt to imitate it in the local production process. Domestic firms may gain access to the multinational's technology by hiring a former MNE-trained worker with special skills. It is precisely this mechanism of technology spillovers that I uncover in the analysis that follows.

This research offers a number of important contributions to the current literature on multinational knowledge spillovers, in large part due to the depth of a novel linked employer-employee database from Brazil. This is the first research, to my knowledge, to offer direct evidence from a large database for a developing country for evidence consistent with positive multinational spillovers through the worker mobility channel. Using matched establishment-worker data, I am able to trace individual workers over time across establishment types. The detailed labor force characteristics allow me to estimate heterogeneous responses of wages depending on worker-level characteristics beyond prior work. In addition, the data include a rich set of establishment-level controls. Moreover, to the best of my knowledge, this is the first research to span all sectors of the economy, not only an individual industry. I go beyond the common manufacturing focus and estimate multinational spillovers in the services sectors where much of the foreign investment in Brazil flowed beginning in 1996. Also, I do not restrict the analysis to senior-level management. I will show that multinational spillovers occur at all skill-levels, and vary by both the skill-level of the former multinational-establishment worker and the skill-level of the incumbent domestic worker.

In contrast to earlier work on this subject, I focus on the worker rather than the firm as the unit of analysis. I measure spillovers as increases in the incumbent domestic worker's wages. Motivated by the social interactions model proposed by Manski (1993), I picture the growth of knowledge occurring when pairwise meetings between individual workers take place. Empirically, the transmission of knowledge occurs through interactions between individual workers; more precisely, between workers who are displaced from multinational establishments and rehired at domestic establishments on the one hand and the incumbent domestic workforce on the other hand. The greater the share of former multinational-establishment workers in an incumbent domestic worker's establishment, the greater the number of possible individual interactions in the domestic-owned establishment and the greater the potential transfer of knowl-

edge. If multinational spillovers through worker mobility exist, I expect workers in establishments hiring a greater share of former multinational-establishment workers to earn higher wages through their potential social interactions with former multinational-establishment workers.

I estimate worker-level regressions using a matched employer-employee data set from Brazil. The Brazilian worker data are collected by the Brazilian Labor Ministry and record characteristics for all formally-registered workers at formally-registered establishments for the years covering 1996 through 2001. The foreign direct investment inflows data are from the Brazilian Central Bank's Registry of Foreign Capital. The two data sources are matched by establishment tax number for the first time in this research to identify workers at foreign-owned and domestic-owned establishments over time. The main benefit of the matched data is the ability to trace workers who "switch" between foreign-owned and domestic-owned establishments.

The findings can be summarized as follows. The main results are consistent with the existence of positive multinational spillovers defined to be the effects of the share of former multinational-establishment workers in the domestic-owned establishment on incumbent domestic workers' wages. The magnitude of wage spillovers from multinational establishments depends on the sector under consideration. Though multinational spillovers are not economy-wide, and in fact, most sectors and most workers do not receive spillover benefits, the results are consistent with the idea that local conditions, such as the level of education, may play an important role in the ability of a country to absorb foreign technological capital.

Evidence by skill-level of the worker supports the hypothesis that higher-skilled former multinational-establishment workers are better able to convey a multinational's technology to incumbent domestic workers and higher-skilled incumbent domestic workers are better able to absorb a multinational's technology from former multinational-establishment workers. The data also report that information is best transferred between similarly-skilled groups of high-skilled workers and from higher skilled former multinational-establishment workers to lower-skilled incumbent domestic workers. The results are robust to worker and establishment fixed effects as well as to different specifications controlling for time-varying, establishment-specific productivity shocks and

worker sorting.

The remainder of this chapter is organized as follows. In the next section, I briefly summarize the literature on multinational spillovers and discuss in detail the evidence for the different potential mechanisms of transmission. In section 1.3, I discuss the empirical methodology, motivated by the social interactions model proposed by Manski (1993). Section 1.4 details the data with descriptive statistics. I present the results from the analysis of multinational spillovers through worker mobility in section 1.5 and identify the sectors that exhibit spillovers. In section 1.6, I distinguish the spillover effect by the skill-level of the displaced former multinational-establishment worker and the incumbent domestic worker in order to uncover how spillovers are absorbed. Additional robustness checks are offered in section 1.7. I conclude with final remarks.

1.2 Literature Review

There is a long history of academic work testing the implications from increased multinational presence on domestic firms.¹ These early studies ask whether multinational spillovers exist, but the mechanisms through which spillovers occur are treated as a black box. However, foreign investment may generate productivity spillovers through a number of different channels: imitation, competition, market access, linkages, and labor turnover. Domestic competitors might successfully imitate technological innovations introduced by MNEs. Production externalities may occur if an increase in competition, as a result of foreign entry, induces firms to become more efficient or to discover new technologies. Aitken and Harrison (1999) show the competition effect may not be positive. For the case of Venezuela, they find increased foreign investment to be negatively related to productivity growth for establishments in the same sector. The authors attribute this negative relationship to the market-squeezing effect of foreign investment. Competition from foreign producers forces out low productivity domestic producers, raising the average productivity of the industry.

Another possible mechanism for the transmission of technology spillovers from multinationals is through market access. The MNE may possess strong links to the

¹For a review of earlier work, see Blomstrom and Kokko (1998).

home country and world markets helping to establish informational networks for local firms. Aitken, Hanson and Harrison (1997) show that Mexican plants have a higher propensity to export the higher is the concentration of MNE exporters in the industry in which the firm produces. This is consistent with the idea that there exist informational externalities to having a foreign presence in a firm's industry. Greenaway, Sousa and Wakelin (2004) confirm the results for an industrialized country, the United Kingdom.

Local firms may also benefit from increased multinational presence if they are suppliers to MNEs. To the extent that multinational firms compete with domestic firms in the same sector, MNEs have an incentive to prevent the leakage of private technology and information. For this reason, evidence of positive *horizontal* spillovers is lacking.² However, it is to the benefit of the MNE if their intermediate input suppliers increase productivity and efficiency. Javorcik (2004) finds evidence consistent with positive *vertical* productivity spillovers from multinational firms to their domestic suppliers using data from Lithuanian plants. In contrast, Alfaro and Rodríguez-Clare (2004) account for the fact that multinational firms may not source inputs from local firms, but rather may import from the home country. With this in mind, they find little evidence of positive vertical spillovers created by backward linkages from multinational firms in Brazil, Chile, Mexico, and Venezuela.

There is evidence at the firm-level, however, for positive horizontal productivity spillovers in industrialized countries (e.g., see Haskel, Pereira and Slaughter (2004) for the United Kingdom and Keller and Yeaple (2004) for the United States), suggesting host country characteristics, such as the level of education of the labor force and institutions, may play an important role in the ability of the country to absorb multinational spillovers. Cohen and Levinthal (1990) first argued that a skill set must be built up by domestic workers in order to implement foreign technologies. This *absorptive capacity* of a firm or an economy is necessary in order to recognize the value of new information and to integrate it into the current production process. Keller (1995) argues that the higher initial stock of human capital in Korea relative to Brazil prior to their respective trade liberalizing experiences and faster Korean growth post-liberalization fits well with this argument.

²The literature defines horizontal spillovers to be within-industry and vertical spillovers to be between-industry.

Labor turnover Worker mobility is a commonly-cited mechanism for the transmission of multinational spillovers. Multinational corporations devote more resources to labor training than domestic firms (e.g., Lindsey (1986) and Gerschenberg (1987)). Under the assumption that this knowledge is not firm-specific, worker mobility can serve as a mechanism for a domestic worker's and domestic firms' acquisition of externally-developed knowledge. In fact, it is not a necessary condition for multinational spillovers through worker mobility that multinational firms offer formal training. If MNEs adopt a new technology or process innovation not available to domestic firms, and workers at multinational firms learn by doing, on-the-job training is a sufficient condition for absorbing and transferring the technology.

Though there is a large theoretical body of work on interfirm worker mobility and knowledge transfer (e.g., Fosfuri, Motta and Ronde (2001) and Cooper (2001)), the existing empirical literature on spillovers through labor turnover is limited to small-sample survey data from a single industry. Gerschenberg (1987) surveyed 72 top- and middle-level managers from 41 manufacturing firms in Kenya. He finds that MNEs in Kenya provide more training for Kenyan managers than locally-owned firms and that labor mobility is lower for managers at multinational firms. He attributes this to the wage premium paid at most MNE firms. Gerschenberg's (1987) sample includes 15 managers who moved from an MNE to a local firm, 4 managers who moved from an MNE to a joint-venture firm, and 9 managers who moved from an MNE to the public sector. The author concludes that the dissemination of managerial know-how is low.

With detailed firm-level data from a sample of 204 Ghanaian manufacturing firms, Gorg and Strobl (2005) focus on the owners of domestic firms who were previously employed at a foreign multinational. Using these data, the authors investigate whether domestic firms which have entrepreneurs with foreign training have a productivity advantage compared to other firms. Out of the 204 domestic firms in Gorg and Strobl's (2005) sample, owners of 13 firms have immediate prior experience working in foreign firms in the same industry, 9 have immediate prior experience working with foreign firms in different industries, and 14 received training provided by foreign firms. Gorg and Strobl (2005) find that firms whose owners once worked in MNEs in the same industry are more productive than similar domestic firms, while firms whose owners worked

in MNEs in different industries have no productivity advantage. The authors argue that MNE knowledge, therefore, may be industry-specific.

Hale and Long (2006) find evidence that labor mobility facilitates multinational productivity spillovers using a sample of 1500 firms in China. In their study, the percentage of managers in domestic firms who have foreign firm experience is positively and significantly associated with FDI presence in the same industry-city cell, even after controlling for industry fixed effects and city fixed effects. Moreover, the percentage of managers with foreign work experience is positively associated with a firm's total factor productivity.

1.3 Empirical Methodology

The objective of this chapter is to identify if multinational spillovers through worker mobility exist. In this chapter, I go beyond the current literature to define wage spillovers at the worker-level.

1.3.1 An econometric model of multinational spillovers

My estimation procedure derives from social interactions theory and allows an individual's outcome to depend on the characteristics of his environment.³ In particular, the approach allows an individual's wage to be a function of a key establishment characteristic, the share of former multinational-establishment workers in the establishment, as follows:

$$\ln y_{ijt} = \gamma S_{jt} + \psi_i + \lambda_{j(i)} + \delta_t + \beta_1 X_{it} + \beta_2 Z_{jt} + \epsilon_{ijt}, \quad (1.1)$$

where i indexes the individual, j indexes the establishment, t indexes time, and $\ln y_{ijt}$ are individual-level log wages. S_{jt} refers to the share of the domestic-owned establishment's workforce with experience in a multinational establishment. This variable is designed to capture the probability that an individual in the domestic-owned establishment interacts with a former multinational-establishment worker.

To account for the fact that periods of establishment hiring tend to coincide with

³See Brock and Durlauf (2001b) and Manski (1993).

general periods of increased investment, i.e., establishments hiring recently displaced multinational-establishment workers may be hiring displaced workers from other domestic-owned establishments as well, I include a control for the share of recently-hired workers from domestic-owned establishments in the establishment, as follows:

$$\ln y_{ijt} = \gamma_M S_{jt}^M + \gamma_D S_{jt}^D + \psi_i + \lambda_{j(i)} + \delta_t + \beta_1 X_{it} + \beta_2 Z_{jt} + \epsilon_{ijt}, \quad (1.2)$$

where S_{jt}^M refers to the previously-defined S_{jt} , the share of the domestic-owned establishment's workforce with experience in a multinational establishment, superscript M . I distinguish this term from S_{jt}^D , with superscript D , the share of the domestic-owned establishment's workforce employed and displaced from another domestic-owned establishment last period.

Equation (1.2) is the basis for the estimation of the empirical results that follow. If positive multinational spillovers through worker mobility exist, I expect $\gamma_M > 0$ and $\gamma_M > \gamma_D$. The main concern in estimating the key coefficient γ_M in (1.2) is the presence of unobservable shocks to individual wages that are correlated with the share of former multinational-establishment workers in the domestic establishment. Any positive correlation between S_{jt}^M and ϵ_{ijt} will result in overestimates of γ_M . A major advantage of using a panel linked worker-establishment data set is that I am able to control for many permanent and time-varying factors that may affect both wages and the overall hiring share. Specifically, I estimate a model that includes individual fixed effects (ψ_i), establishment fixed effects ($\lambda_{j(i)}$), time fixed effects (δ_t), time-varying, worker characteristics (X_{it}), such as age, experience, tenure at the establishment, education, and skill-intensity of occupation, and time-varying, establishment characteristics (Z_{jt}), such as log average establishment size, average establishment tenure, average establishment experience, average establishment education, and average skill-intensity of the occupations in the establishment.

Due to the inclusion of S_{jt}^D and the desire to ensure that the estimates measure pure spillover effects and not compositional effects, I restrict the data to the retained domestic workforce.⁴ Because the sample of workers are restricted to remain in the same establishment, individual fixed effects (ψ_i) fully absorb the establishment-specific ef-

⁴Please see appendix A.1 for more information on the data construction.

fects ($\lambda_{j(i)}$). ψ_i captures unmeasured individual characteristics that do not change over time, such as unobserved ability and motivation, while $\lambda_{j(i)}$ captures unobserved, time-invariant establishment-level characteristics, such as unobserved productivity. δ_t captures general trends in wages that affect all workers, in particular related to Brazil's currency crisis in 1999. ϵ_{ijt} represents an error term that is assumed to be well-behaved, that is, to exhibit no serial correlation, and to be orthogonal to all regressors.

1.4 Data

My main data source is a database of Brazilian formal-sector workers. I match key worker characteristics to a complementary data source on establishment-level foreign investment inflows.

1.4.1 Worker data

The worker data come from the Brazilian Labor Ministry (*Ministério do Trabalho e Emprego* (MTE)) which requires all formally-registered firms to report on all formally-employed workers in every year. The *Relação Anual de Informações Sociais* (RAIS) is an individual-level data set consisting of all workers for the years 1996 through 2001. The main variables of interest are the worker's identification code (*Programa de Integração* (PIS)),⁵ annual real wages in *reais*, job tenure in years, contracted hours of work, month and type of accession, month and type of separation, gender, nationality, age, educational attainment of the worker, the occupational classification of the worker (*Classificação Brasileira de Ocupações* (CBO)), the tax number of the worker's establishment (*Cadastro Nacional de Pessoa Jurídica* (CNPJ)), and the industrial classification of the worker's establishment (*Classificação Nacional de Atividades Econômicas* (CNAE)).

The RAIS worker data is particularly valuable to this research agenda as it offers variables beyond the available information in many other matched employer-employee

⁵A worker's ID remains with the worker throughout his work history. The process for establishments to report on their workers is extensive and costly. However, PIS records are used to administer payment of the annual public wage supplements to every formally-employed worker, thus creating a strong incentive for workers to urge their employers to report accurately.

databases. First, the industry classifications (CNAE) cover workers beyond the common manufacturing focus. Workers in the services and utilities industries, where much of the foreign investments flowed starting in 1996 are included in the database.⁶ Next, RAIS has a depth of information on the cause of separation, as well as a worker's tenure at the firm and detailed skills (as defined by occupation and education) which are paramount to the analysis.

The main advantage of the RAIS database is the ability to track individual workers in establishments over time by worker identification codes and establishment tax numbers, respectively. I restrict observations as follows. First, only workers with correct eleven-digit worker identification numbers are included.⁷ Next, the sample includes only full-time, prime age workers; that is, workers between the ages of 15 and 64 years⁸ who work at least 40 contracted hours per week. Following Abowd, Kramarz and Margolis (1999), I restrict the set of workers to only those workers receiving positive wages in a private sector job. Finally, for workers with multiple jobs within the same establishment in a given year, only the most recent job is included in the sample. If a worker has multiple current jobs, only the highest paying job is included.⁹

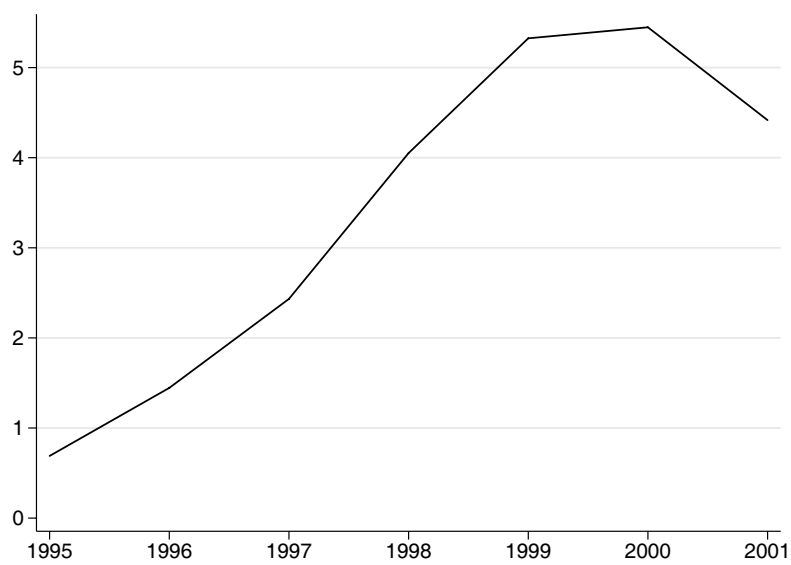
Muendler, Poole, Ramey and Wajnberg (2004) map the CBO to the *International Standard Classification of Occupations* (ISCO-88). The CBO-94 is a detailed, task-oriented classification system, while ISCO-88 reflects a less-detailed and more skill-

⁶The data include workers in all private sectors of the economy: agriculture, commerce, construction, manufacturing, and services. For this study, sectors are classified into 2-digit CNAE sectors. I exclude 7 2-digit sectors from the analysis: Manufacture of furniture, manufacture not elsewhere classified (36); Other business activities (74); Public administration and defense, compulsory social security (75); Activities of membership organizations (91); Recreational, cultural, and sporting activities (92); Other Service Activities (93); and Activities of households as employers of domestic staff (95). For some levels of analysis, I further aggregate the data into the three major sectors: primary, manufacturing, and services. Primary includes 2-digit CNAE codes 1-14; manufacturing includes 2-digit CNAE codes 15-37; and services includes 2-digit CNAE codes 40-90.

⁷Eleven digits is the traditional length of the social security number in Brazil. Firms that report false identification numbers are either reporting informal workers or the data are more likely to have measurement error due to faulty bookkeeping.

⁸The legal working age in Brazil is 16 years of age. Before the Social Security reform of 1999, the earliest retirement age for women and men in Brazil was 55 and 60, respectively.

⁹There is high turnover within establishments within a year in part due to a Brazilian labor law (*Fundo de Garantia de Tempo de Serviço* (FGTS)) in which formally-employed workers may receive a guaranteed fund upon termination. This fund is filled by the employer in monthly contributions and subsidized by the government. The Fund is meant to serve both as unemployment insurance upon layoff and as a social security payment at retirement.



Source: World Bank, 2005.

Figure 1.1: Foreign Direct Investment Inflows as Percentage of GDP, 1995-2001

oriented classification system. The skill classification is intended to incorporate on-the-job experience, informal training, and the technological skill content of the occupation.¹⁰ The ISCO occupations are then grouped into four broad occupational categories following Abowd, Kramarz, Margolis and Troske (2001). I consider these occupational categories to reflect the skill-intensity of the occupation. Table A.1 in appendix A.3 presents the breakdown of the skill-intensity of occupations by major ISCO occupational grouping.

1.4.2 Foreign direct investment in Brazil

Figure 1.1 shows foreign direct investment inflows as a percentage of GDP for the Brazilian economy from 1995 to 2001 (World Bank (2005)). Direct investments increased significantly beginning in 1996, and more than quadrupled by 2001.¹¹ There is also considerable variation in the amount of foreign investment across sectors. In

¹⁰Created by the International Labor Organization, the ISCO is ideal for developing and industrialized cross-country comparisons. Contact the author for more details about the CBO-ISCO concordance and see Elias and Birch (1994) for more information on the skill classification of the ISCO.

¹¹Appendix A.2 offers a detailed description of the policy reforms in Brazil that contributed to the marked increases in investment inflows.

Table 1.1: Foreign Direct Investment Inflows, 1996-2001

	Average	Standard Deviation	Minimum	Maximum
Services	584.6	1,183.7	0.1	4,528.6
Manufacturing	192.8	272.5	3.2	985.0
Primary	78.0	134.1	0.0	370.2
All Sectors	346.0	816.9	0.0	4,528.6

Note: Inflows data are expressed in USD millions. Statistics are calculated across 2-digit CNAE sectors within services, manufacturing, and primary. Services includes 2-digit CNAE codes 40-90, manufacturing includes 2-digit CNAE codes 15-37, and primary includes 2-digit CNAE codes 1-14.

Source: BCB, 1996-2001.

1995, the total stock of foreign investment in Brazil was 116 billion US dollars, with 65 percent in manufacturing, 31 percent in services, and 4 percent in agricultural industries. Starting in 1996, the scope of foreign investment shifted towards the service sectors in part due to the government's privatization of many public services (Rodrigues (2000)). Table 1.1 documents the variation across major sectors and the rise in foreign investment inflows to the services sector. Between 1996 and 2001, 73 percent of foreign investments flowed to service sectors, 24 percent flowed to manufacturing sectors, and just 3 percent to primary sectors. The telecommunications, banking, and electricity sectors, which underwent large-scale privatizations, received the largest flows of foreign funds.

Foreign Investment Data By law, all foreign direct investment inflows to Brazil are required to be registered with the Central Bank of Brazil (BCB) in the *Registro Declaratório Eletrônico - Investimentos Externos Diretos* (RDE-IED). The RDE-IED is available from the BCB for the years 1996 through 2001. I define an establishment to be foreign-owned in year t if the establishment received an inflow of foreign capital in year t . I note that establishments receiving inflows of foreign capital in year t may maintain foreign relationships in later years. Therefore, establishments are counted as foreign-owned in all years $\tau \geq t$ after the initial inflow in year t . Finally, I consider foreign funds at the holding-company level to affect all establishments of the corporate group. Using BCB information on corporate ownership relations among Brazilian firms, I count an establishment as foreign-owned in year $\tau \geq t$ if it is a subsidiary of a company receiving inflows of foreign capital in year t .¹²

¹²By my definition, a foreign-owned establishment which did not receive any foreign capital inflows

Table 1.2: Multinational Share, 1996-2001

	Average	Standard Deviation	Minimum	Maximum
Services	0.0070	0.0064	0.0003	0.0193
Manufacturing	0.0181	0.0147	0.0006	0.0483
Primary	0.0289	0.0415	0.0013	0.0971
All Sectors	0.0148	0.0193	0.0003	0.0971

Note: The multinational share in the sector is defined to be the number of multinational establishments as a share of total establishments in the sector. Statistics are calculated across 2-digit CNAE sectors within services, manufacturing, and primary. Services includes 2-digit CNAE codes 40-90, manufacturing includes 2-digit CNAE codes 15-37, and primary includes 2-digit CNAE codes 1-14.

Sources: RAIS, RDE-IED, 1996-2001.

The data are matched by establishment tax number to the RAIS worker data for the first time in this research. I define an indicator variable equal to one if and only if a worker holds a job at a foreign-owned establishment. Workers employed at foreign-owned establishments are hereafter referred to as “multinational-establishment workers”, while workers employed at domestic-owned establishments are hereafter referred to as “domestic workers”. The matched RAIS-RDE-IED data traces workers who “switch” between foreign-owned and domestic-owned establishments. I call workers displaced from multinational establishments and rehired in domestic establishments “MNE-to-non-MNE switchers”. The sample includes 205,465 domestic establishments hiring 1,626,105 MNE-to-non-MNE switchers from 13,009 multinational establishments over the period 1996 to 2001.

Table 1.2 presents a summary of the share of foreign-owned establishments for each 2-digit CNAE sectors in my sample. As a share of the number of establishments in the sector, the health and social work and education service sectors have the smallest multinational shares, 0.03 and 0.04 percent, respectively, while almost 10 percent of the establishments in the metal mining industry received foreign investment inflows between 1996 and 2001 according to RDE-IED.

between 1996 and 2001 is considered a domestic-owned establishment. In combination with information on the stock of foreign investments in 2001, I am confident that I have identified all foreign-owned establishments.

1.4.3 Descriptive statistics

In this section, I present statistics that describe the MNE-to-non-MNE switcher workers, the domestic-owned establishments that hire them, and the incumbent domestic workforce.¹³

National Data First, I offer statistics from a nationally representative sample of workers by major industrial sector.¹⁴ Table 1.3 displays average worker characteristics for the Brazilian labor force. Between 1996 and 2001, the average worker earned approximately 4,024 *reais* per year (approximately \$2,000 at current exchange rates). The worker is early in his career at 33 years of age. Approximately 26 percent of the labor force is female. Fifty-seven percent of the formal-sector labor force have a primary school education, close to 30 percent have a high school diploma, and just over 13 percent have a college degree. The majority of workers in Brazil are skilled blue collar workers (43 percent). Almost 12 percent of workers are unskilled blue collar workers, 13 percent are other white collar workers, and 30 percent are professional and technical workers.

The services sector pays a wage 0.1 percent higher than average, employs older workers, and employs more women. Workers in the services sector are more skilled than the national average, by measures of education and the skill-intensity of the occupation. The manufacturing sector pays 0.1 percent less than the national average and employs workers on average one year younger. Workers in the manufacturing sector are less skilled than the national average, by both measures of skill. The primary sector pays 0.1 percent less than the national average, employs older workers, and fewer women. Workers in the primary sector are less skilled than the national average, by measures of education and the skill-intensity of the occupation.

Displaced Multinational Workers Table 1.4 presents the same statistics for the set of displaced multinational workers by major industrial sector. The average wage of a switcher worker for the period 1996 to 2001 was 0.3 percent higher than the national average. The wage differential is most significant in the manufacturing and services sec-

¹³Please see appendix A.1 for a complete description of the data construction.

¹⁴Statistics are calculated across 2-digit CNAE sectors within services, manufacturing, and primary. Services includes 2-digit CNAE codes 40-90, manufacturing includes 2-digit CNAE codes 15-37, and primary includes 2-digit CNAE codes 1-14. Detailed data are available by request from the author.

Table 1.3: National Worker Characteristics, 1996-2001

	Services	Manufacturing	Primary	All Sectors
Ave. Wage (in logs)	8.4	8.2	8.2	8.3
Ave. Age (in years)	34	32	35	33
Percent Female	0.311	0.260	0.096	0.260
<i>Share of Workers with:</i>				
Primary School	0.455	0.626	0.744	0.568
High School	0.346	0.285	0.187	0.298
College Degree	0.198	0.088	0.067	0.132
<i>Share of Workers:</i>				
Unskilled Blue Collar	0.122	0.100	0.142	0.115
Skilled Blue Collar	0.198	0.612	0.599	0.431
Other White Collar	0.221	0.071	0.045	0.132
Professional & Technical	0.442	0.197	0.187	0.301

Note: Statistics are calculated across 2-digit CNAE sectors within services, manufacturing, and primary. Services includes 2-digit CNAE codes 40-90, manufacturing includes 2-digit CNAE codes 15-37, and primary includes 2-digit CNAE codes 1-14. Source: RAIS, 1 percent random sample, 1996-2001.

Table 1.4: Displaced Multinational Worker Characteristics, 1996-2001

	Services	Manufacturing	Primary	All Sectors
Ave. Wage (in logs)	8.8	8.6	8.4	8.6
Ave. Age (in years)	33	33	34	33
Percent Female	0.262	0.225	0.068	0.219
<i>Share of Workers with:</i>				
Primary School	0.313	0.455	0.651	0.421
High School	0.346	0.351	0.224	0.332
College Degree	0.330	0.194	0.125	0.243
<i>Share of Workers:</i>				
Unskilled Blue Collar	0.091	0.100	0.128	0.100
Skilled Blue Collar	0.191	0.534	0.606	0.396
Other White Collar	0.197	0.073	0.036	0.121
Professional & Technical	0.501	0.276	0.216	0.365
Switcher Share	0.019	0.026	0.023	0.023

Note: The switcher share in the sector is defined as the number of MNE-to-non-MNE switchers hired by the establishment as a share of the establishment workforce. Statistics are calculated across 2-digit CNAE sectors within services, manufacturing, and primary. Services includes 2-digit CNAE codes 40-90, manufacturing includes 2-digit CNAE codes 15-37, and primary includes 2-digit CNAE codes 1-14. Sources: RAIS, RDE-IED, 1996-2001.

tors, where MNE-to-non-MNE switchers earn, on average, 0.4 percent higher than the average national worker in his sector. The higher wages may reflect the wage premium

often paid by MNE establishments (e.g., Gerschenberg (1987) and Lipsey (2004)). Workers displaced from foreign-owned establishments and rehired by domestic-owned establishments are, on average, in their early careers, no different from the national average. Switchers are less likely to be female. Across all sectors, former multinational establishment workers are relatively higher skilled, as defined by education and occupation, than the average national worker. Given the evidence in the literature on the high-skill-intensity of multinational establishments, it is not surprising that workers displaced from MNEs are relatively higher skilled.

Across all sectors, 2.3 percent of the workforce switched from a multinational to a domestic establishment during the period 1996 to 2001. The switcher share, defined to be the number of MNE-to-non-MNE switchers hired by each establishment as a share of the establishment workforce, is highest in the manufacturing sector at 2.6 percent. Almost 2.0 percent of workers in the services sector switched from a multinational to a domestic establishment during the period 1996 to 2001, while 2.3 percent of workers in the primary sector have experience in a foreign-owned establishment.

The argument in this chapter rests on a worker learning while at the multinational establishment and having the ability to transfer this knowledge to workers at the domestic establishment. The longer a worker is employed at the multinational establishment, the greater the potential information absorbed and transferred. By the same measure, if a worker is not employed at an MNE for an appropriate length of time, my argument will not hold. The average duration of employment at a multinational establishment for MNE-to-non-MNE switchers in the sample of data is 3.4 years. Meanwhile, the average duration of employment for non-MNE switchers and for incumbent domestic workers is 2.2 years and 4.7 years, respectively.

Domestic-Owned Establishments Table 1.5 reports statistics across domestic-owned establishments that hire the MNE-to-non-MNE switchers. Here, the appropriate comparison group is the set of domestic-owned establishments that did not hire any MNE-to-non-MNE switchers. Descriptive statistics for these establishments are reported in table 1.6 that follows.

Domestic-owned establishments hiring former multinational establishment workers pay average wages 0.4 percent higher than establishments which did not hire switcher

Table 1.5: Domestic-Owned Establishments Hiring Switchers, 1996-2001

	Services	Manufacturing	Primary	All Sectors
Ave. Wage (in logs)	8.6	8.4	8.3	8.5
Percent Female	0.319	0.254	0.096	0.260
<i>Share of Workers with:</i>				
Primary School	0.402	0.593	0.713	0.527
High School	0.371	0.305	0.211	0.320
College Degree	0.227	0.102	0.076	0.153
<i>Share of Workers:</i>				
Unskilled Blue Collar	0.114	0.098	0.148	0.112
Skilled Blue Collar	0.187	0.559	0.580	0.401
Other White Collar	0.213	0.081	0.057	0.134
Professional & Technical	0.472	0.237	0.194	0.332
Ave. Establishment Size	145.3	143.6	163.0	147.0

Note: Statistics are calculated across 2-digit CNAE sectors within services, manufacturing, and primary. Services includes 2-digit CNAE codes 40-90, manufacturing includes 2-digit CNAE codes 15-37, and primary includes 2-digit CNAE codes 1-14.
Source: RAIS, 1996-2001.

Table 1.6: Domestic-Owned Establishments Not Hiring Switchers, 1996-2001

	Services	Manufacturing	Primary	All Sectors
Ave. Wage (in logs)	8.2	8.0	7.9	8.1
Percent Female	0.342	0.262	0.116	0.276
<i>Share of Workers with:</i>				
Primary School	0.472	0.684	0.780	0.606
High School	0.383	0.258	0.157	0.298
College Degree	0.143	0.056	0.060	0.094
<i>Share of Workers:</i>				
Unskilled Blue Collar	0.116	0.105	0.184	0.120
Skilled Blue Collar	0.207	0.580	0.524	0.411
Other White Collar	0.226	0.076	0.074	0.140
Professional & Technical	0.435	0.207	0.190	0.303
Ave. Establishment Size	29.9	35.7	38.5	33.6

Note: Statistics are calculated across 2-digit CNAE sectors within services, manufacturing, and primary. Services includes 2-digit CNAE codes 40-90, manufacturing includes 2-digit CNAE codes 15-37, and primary includes 2-digit CNAE codes 1-14.
Source: RAIS, 1996-2001.

workers. Similarly, the average establishment size, as measured by the number of workers, is greater, across all sectors, for establishments hiring switcher workers than for establishments not hiring a single MNE-to-non-MNE switcher. The extensive litera-

ture documenting the employer-size wage premium may explain the wage differentials between these establishment types (Brown and Medoff (1989)). Domestic-owned establishments hiring switchers and domestic-owned establishments not hiring switchers do not otherwise appear to be systematically different by measures of gender composition and the skill sets of the workforce.

The availability of the matched establishment-employee database allows me to control for these important observable establishment-level characteristics in the estimation of multinational spillovers through worker mobility. Furthermore, if there are unobservable characteristics underlying these observable differences, the estimation method proposed in section 1.3 will control for these unobservable differences through the establishment fixed effects nested within the worker fixed effects.

Incumbent Domestic Workers Descriptive statistics on the incumbent domestic workforce in the domestic-owned establishments hiring MNE-to-non-MNE switchers are reported in table 1.7. The incumbent domestic worker earned 0.1 percent more than the average national worker, across all sectors, during the period 1996 to 2001. This wage differential carries to the manufacturing and services sectors, but the average incumbent domestic worker earned equally much, on average, as the average national worker in the primary sector. With respect to displaced multinational workers, however, the incumbent domestic workforce earned 0.2 percent less over the 1996 to 2001 period, suggesting switcher workers find themselves in the top of the hiring establishment's wage distribution. I will exclude all switcher workers from the multinational spillovers regression on incumbent domestic workers' wages in order to ensure the analysis measures pure spillovers effects and not compositional effects.

The incumbent domestic worker is, on average, one year older than the national-average worker, while the MNE-to-non-MNE switcher workers are younger than the incumbent domestic workforce. The workers in domestic establishments hiring switchers in the primary sector are more likely to be female than the national-average worker in a primary sector establishment. Otherwise, the incumbent domestic workforce appears similar in terms of gender composition to the national sample. However, as I mentioned in the previous section, displaced multinational establishment workers are more likely to be male. Therefore, the incumbent domestic workforce appears disproportionately

Table 1.7: Incumbent Domestic Worker Characteristics, 1996-2001

	Services	Manufacturing	Primary	All Sectors
Ave. Wage (in logs)	8.5	8.3	8.2	8.4
Ave. Age (in years)	35	33	36	34
Percent Female	0.316	0.272	0.137	0.272
<i>Share of Workers with:</i>				
Primary School	0.456	0.646	0.711	0.573
High School	0.346	0.272	0.207	0.295
College Degree	0.198	0.082	0.081	0.132
<i>Share of Workers:</i>				
Unskilled Blue Collar	0.124	0.093	0.132	0.112
Skilled Blue Collar	0.188	0.621	0.568	0.427
Other White Collar	0.215	0.071	0.062	0.132
Professional & Technical	0.460	0.198	0.222	0.314

Note: Statistics are calculated across 2-digit CNAE sectors within services, manufacturing, and primary. Services includes 2-digit CNAE codes 40-90, manufacturing includes 2-digit CNAE codes 15-37, and primary includes 2-digit CNAE codes 1-14. Source: RAIS, 1996-2001.

Table 1.8: Share of Former Multinational-Establishment Workers, 1996-2001

	Standard			
	Average	Deviation	Minimum	Maximum
Services	0.019	0.010	0.006	0.045
Manufacturing	0.026	0.021	0.008	0.109
Primary	0.023	0.017	0.007	0.049
All Sectors	0.023	0.017	0.006	0.109

Note: The share of former multinational-establishment workers in an establishment is defined as the number of MNE-to-non-MNE switchers as a share of the establishment workforce. Statistics are calculated across 2-digit CNAE sectors within services, manufacturing, and primary. Services includes 2-digit CNAE codes 40-90, manufacturing includes 2-digit CNAE codes 15-37, and primary includes 2-digit CNAE codes 1-14. Source: RAIS, 1996-2001.

female with respect to this group. Similarly, incumbent domestic workers in hiring domestic establishments mirror the skill composition of the national sample, while they are relatively less skilled than displaced multinational establishment workers. Switcher workers, on average, are among the top of the hiring establishment's skill distribution, when skill is measured by both education and occupation.

Share of Former Multinational-Establishment Workers Table 1.8 reports descriptive statistics for the main variable of interest, the share of former multinational-establishment workers, S_{jt}^M .¹⁵ On average, 2.6 percent of manufacturing sector workers

¹⁵A detailed listing of the average shares of former multinational-establishment workers by 2-digit

were once employed at a foreign-owned establishment, while 2.3 percent of primary sector workers and only 1.9 percent of service workers. On average, establishments in the tobacco manufacturing sector have the largest foreign presence in their workforces (10.9 percent), while the education and health services sectors have the smallest foreign presence in their workforces (0.6 percent).

1.5 Estimation of Multinational Spillovers

Recall from section 1.3 the main empirical specification:

$$\ln y_{ijt} = \gamma_M S_{jt}^M + \gamma_D S_{jt}^D + \psi_i + \lambda_{j(i)} + \delta_t + \beta_1 X_{it} + \beta_2 Z_{jt} + \epsilon_{ijt}.$$

where S_{jt}^M refers to the share of the domestic-owned establishment's workforce with experience in a multinational establishment and S_{jt}^D measures the share of the domestic-owned establishment's workforce employed and displaced from another domestic-owned establishment. If positive multinational spillovers through worker mobility exist, I expect $\gamma_M > 0$ and $\gamma_M > \gamma_D$. Identification in this model is based on changes over time in the share of former multinational-establishment workers within an establishment for each worker. The covariates include a vector of time-varying individual-specific characteristics, X_{it} , and a vector of time-varying establishment-specific characteristics, Z_{jt} .¹⁶ The individual characteristics include age, age-squared, experience, experience-squared, tenure at the establishment, education,¹⁷ and the skill-intensity of occupation.¹⁸ The establishment characteristics include log average establishment size, age,¹⁹ average establishment tenure, average establishment experience, share of the establishment female,

CNAE sector is reported in table 1.10.

¹⁶Because I include individual fixed effects, variables that do not change over time such as gender and nationality are not included.

¹⁷Education enters into the equation as 3 dummies; primary school, high school, and college graduate (primary school is the omitted category).

¹⁸Skill-intensity of occupation enters into the equation as 4 dummies; unskilled blue collar, skilled blue collar, other white collar, and professional (unskilled blue collar is the omitted category).

¹⁹Age enters as 7 shares; Share of the establishment aged child (10-14 years), youth (15-17 years), adolescent (18-24 years), nascent career (25-29 years), early career (30-39 years), peak career (40-49 years), late career (50-64 years), post retirement age (65 years or older).

Table 1.9: Multinational Spillovers, 1996-2001

Dep. Variable: Log Annual Wages	(1)	(2)	(3)	(4)	(5)
$\gamma_M - \gamma_D$	0.977**	1.071**	-0.025	0.075**	0.077**
<i>F-statistic</i>	15.29	75.87	1.00	10.38	13.10
<i>p-value</i>	0.0001	0.0000	0.3183	0.0013	0.0003
Average Establishment Wages					0.220**
<i>Robust Standard Error</i>					(0.017)
Individual Fixed Effects	NO	NO	NO	YES	YES
Establishment Fixed Effects	NO	NO	YES	YES	YES
Time Fixed Effects	NO	YES	YES	YES	YES
Number of Observations	450,842	2,634,947	2,634,947	2,634,947	2,629,404
Overall R-squared	0.5483	0.5403	0.3948	0.2658	0.5181

Note: Robust standard errors, clustered at the establishment-level, are in parentheses. ** denotes significance at 1 percent level; * denotes significance at 5 percent level. See section 1.5 for other independent variables included in the estimation (not reported here).

Source: RAIS, 10 percent random sample, 1996-2001.

average education,²⁰ and average skill-intensity of occupation.²¹

1.5.1 Main results

Table 1.9 presents results from the estimation of worker-level multinational spillovers with individual, establishment, and annual fixed effects, unless otherwise indicated. For this analysis, I draw a ten percent random sample of the incumbent domestic workforce across all sectors. I report the coefficient difference for $\gamma_M - \gamma_D$ and the accompanying *F-statistic* and *p-value* for the null hypothesis of a zero difference. All other independent variables that are included in the analysis are listed in the previous section. In order to precisely estimate both γ_M and γ_D , I cluster the robust standard errors at the establishment-level.²²

In column (1), I present the cross-sectional analysis for the year 2000. The results are consistent with multinational spillovers though without establishment and individual

²⁰Education enters as 3 shares; Share of the establishment with primary school, high school, and college graduate.

²¹Skill-intensity of occupation enters as 4 shares; Share of the establishment unskilled blue collar worker, skilled blue collar worker, other white collar worker, and professional worker.

²²Moulton (1990) points out that because observations are at the worker-level, yet the main variable of interest varies by establishment, standard errors may be underestimated. Furthermore, Bertrand, Duflo and Mullainathan (2004) find that serial correlation of the errors can also be a problem.

fixed effects, the result is difficult to interpret. In column (2), I bring in the full panel of data and allow for time series variation. The large, positive effects in columns (1) and (2) resemble the early generations of work on knowledge spillovers from multinational enterprises (e.g., Blomstrom and Kokko (1998) and the references therein). I include establishment fixed effects in column (3), which control for any fixed factor that may affect an establishment's decision to hire former multinational-establishment workers, such as management style. As was found in the third generation of studies on multinational spillovers (e.g., Aitken and Harrison (1999)), the differential effect of hiring former multinational-establishment workers over other domestic hires no longer has a positive effect on incumbent workers' wages. The omitted variable bias for the establishment fixed effect is large and positive. This is consistent with the evidence presented in the descriptive statistics section—on average, establishments with higher shares of former multinational-establishment workers are also higher wage establishments.

Column (4) also includes individual fixed effects, in order to control for any unobservable individual characteristics, such as motivation or ability that may determine an individual's wages. It is clear that incumbent domestic workers are not randomly assigned to the establishments in which they work. Even after considering individual fixed effects, workers' wages increase with the proportion of co-workers in their establishment who have experience in foreign-owned establishments ($\gamma_M - \gamma_D$ is significantly different from zero). The omitted variable bias for the worker fixed effect is large, but negative. This result foreshadows those to come—low-earning individuals learn more.

In the final column, I test the inclusion of an additional time-varying establishment-level variable, average establishment wages. Ideally, my specification would include all possible time-varying, establishment-level variables so as to capture all possible establishment-level shocks. I test the inclusion of this variable separately given the so-called reflection problem discussed in Manski (1993). The main result in column (5) shows that including average establishment wages changes the result minimally and only serves to increase the explanatory power of the regression.

In my most preferred and robust specification in column (4), a one percentage-point increase in the share of former multinational-establishment workers in a domestic-owned establishment, holding the share of non-MNE switcher workers constant, in-

creases an incumbent worker's wages by approximately 0.1 percent. To help interpret the magnitude of the coefficient, consider that the average change in the share of former multinational-establishment workers between 1996 and 2001 was about one percentage-point per year.

1.5.2 Multinational spillovers by sector

In the previous section, I presented evidence consistent with the existence of positive multinational spillovers through worker turnover for the economy. In this section, I ask what sectors account for the multinational spillovers. The theory of social interactions considers the transfer of information between individuals an important element. So, we may expect that higher-skilled individuals are better suited to transfer information. As such, high-skill intensive sectors, as defined by the high school plus college educated share of the workforce may be expected to experience larger multinational spillovers.

Tables 1.10 and 1.11 present results from the estimation of worker-level multinational spillovers with individual, establishment, and annual fixed effects. Each row represents a unique individual-level regression as in equation (1.2) by 2-digit CNAE sector. I report the coefficient for $\gamma_M - \gamma_D$, as well as the individual coefficients.²³ All other independent variables that are included in the analysis are listed in the introduction to this section. As in the previous analysis, robust standard errors are clustered at the establishment-level. I report the skill-intensity of the sector, as defined by the share of the workforce with a high school or college education, and the average share of former multinational-establishment workers alongside the regression results, and sort the results by the skill-intensity of the sector. The results are also grouped into skill quintiles.

In general, the results present strong evidence for the existence of wage gains as a result of increased multinational presence in the establishment, even after controlling for the general hiring trends of the establishment. In 6 of the 51 2-digit CNAE sectors analyzed, the differential effect of the share of MNE-switcher workers in the establishment beyond the effect of non-MNE switcher workers in the establishment is positively

²³The accompanying *F-statistic* and *p-value* for the null hypothesis that the difference is zero are available in an appendix by request.

Table 1.10: Multinational Spillovers by 2-digit CNAE Sector, 1996-2001

Dep. Variable: Log Annual Wages												
2-digit CNAE	Description	$\gamma_M - \gamma_D$	γ_M	γ_D	Number of Observations	R^2	Skill Intensity	Foreign Presence Share				
Highest Quintile												
65	Financial intermediation	0.179	0.085	-0.094	275,330	0.1704	0.919	0.022				
66	Insurance and pension funding	0.138	0.062	-0.076	101,803	0.1403	0.897	0.025				
72	Computer and related activities	0.041	0.003	-0.039	236,521	0.1295	0.865	0.045				
67	Activities auxiliary to financial intermediation	0.121	0.068	-0.053	54,342	0.2457	0.813	0.028				
62	Air transport	0.945	0.500*	-0.445	63,312	0.2264	0.793	0.021				
11	Extraction of crude petroleum and natural gas	0.758	0.486*	-0.272	19,370	0.0831	0.742	0.049				
64	Post and telecommunications	0.073	0.114	0.041	301,280	0.1554	0.731	0.033				
40	Electricity, gas, steam and hot water supply	0.146	0.052	-0.095	200,086	0.0172	0.729	0.028				
73	Research and development	0.939	1.165**	0.226	61,726	0.0212	0.714	0.013				
30	Manufacture of office machinery and computers	-0.343	0.055	0.398	28,314	0.2723	0.695	0.045				
80	Education	0.168*	0.203*	0.035	1,089,814	0.3420	0.689	0.006				
4th-Quintile												
32	Manufacture of radio, television and communication equipment	0.350*	0.103**	-0.247	93,135	0.3022	0.570	0.045				
85	Health and social work	0.011	0.047	0.037*	1,530,229	0.2050	0.561	0.006				
22	Publishing, printing and reproduction of recorded media	0.121	0.148*	0.027	335,598	0.2717	0.534	0.014				
63	Supporting and auxiliary transport activities; travel agencies	0.062	0.121**	0.060	237,425	0.2103	0.521	0.023				
33	Manufacture of medical, precision and optical instruments	0.115	0.107	-0.008	77,995	0.2107	0.510	0.027				
13	Mining of metal ores	0.650	0.477*	-0.173	64,470	0.1878	0.495	0.036				
52	Retail trade; repair of personal and household goods	0.047**	0.046**	-0.001	2,950,440	0.1785	0.487	0.011				
24	Manufacture of chemicals and chemical products	0.007	0.020	0.013	526,063	0.2239	0.486	0.030				
35	Manufacture of other transport equipment	-0.188	0.039	0.226	53,986	0.4757	0.459	0.027				
41	Collection, purification and distribution of water	-0.852	-0.236	0.616	259,179	0.0941	0.449	0.008				
3rd-Quintile												
51	Wholesale trade and commission trade	0.105**	0.137**	0.032	989,641	0.2394	0.447	0.017				
50	Sale, repair of motor vehicles; retail sale of fuel	0.041	0.025	-0.016	749,516	0.2484	0.441	0.011				
61	Water transport	0.438	0.081	-0.357*	32,266	0.2575	0.433	0.023				
71	Renting of machinery and equipment	0.075	0.072	-0.003	62,894	0.2337	0.430	0.020				
31	Manufacture of electrical machinery n.e.c.	-0.110	-0.078	0.032	251,180	0.2591	0.397	0.028				
34	Manufacture of motor vehicles, trailers and semi-trailers	0.075	0.028**	-0.047	601,943	0.4892	0.390	0.035				
29	Manufacture of machinery and equipment n.e.c.	0.083	0.124**	0.041	558,131	0.2584	0.379	0.037				
27	Manufacture of basic metals	0.145	0.123*	-0.022	397,222	0.4109	0.377	0.021				
21	Manufacture of pulp, paper and paper products	-0.107	0.026*	0.133	260,331	0.3326	0.368	0.020				
16	Manufacture of tobacco products	-0.737	0.035	0.772	40,415	0.0689	0.302	0.109				

Note: Each row represents a unique individual-level regression as in equation (1.2) for each sector. All specifications include annual time dummies, individual, and establishment fixed effects. ** denotes significance at 1 percent level; * denotes significance at 5 percent level. Robust standard errors are clustered at the establishment-level. See section 1.5 for other independent variables included in the estimation (not reported here). The skill-intensity of the sector is defined as the share of the workforce with a high school or college education. The foreign presence share in an establishment is defined as the number of MNE-to-non-MNE switchers as a share of the establishment workforce.
Source: RAIS, 1996-2001.

Table 1.11: Multinational Spillovers by 2-digit CNAE Sector, 1996-2001: Continued

Dep. Variable: Log Annual Wages												
2-digit CNAE	Description	$\gamma_M - \gamma_D$	γ_M	γ_D	Number of Observations	R^2	Skill Intensity	Foreign Presence Share				
<i>2nd-Quintile</i>												
25	Manufacture of rubber and plastic products	0.124	0.047	-0.076	602,046	0.3360	0.290	0.021				
10	Coal Mining	-0.824	-0.053	0.771	6,802	0.0159	0.287	0.007				
28	Manufacture of fabricated metal products	0.109*	0.077**	-0.032	619,341	0.2490	0.287	0.024				
18	Manufacture of apparel	0.042	0.101**	0.059*	678,200	0.2425	0.272	0.010				
17	Manufacture of textiles	0.032	-0.033	-0.066	713,747	0.1915	0.262	0.015				
55	Hotels and restaurants	-0.038**	-0.008	0.029*	1,011,209	0.1455	0.250	0.010				
15	Manufacture of food products and beverages	0.262**	0.254**	-0.008	1,963,912	0.0618	0.241	0.011				
70	Real estate activities	-0.002	-0.018	-0.017	446,905	0.1632	0.239	0.010				
19	Manufacture of luggage, handbags, saddlery, harness and footwear	0.124	0.120*	-0.004	655,803	0.1290	0.227	0.015				
60	Land transport; transport via pipelines	0.222**	0.141**	-0.081	2,311,445	0.3069	0.223	0.012				
<i>Lowest Quintile</i>												
26	Manufacture of other non-metallic mineral products	-0.044	0.003	0.048	499,193	0.3431	0.220	0.011				
23	Manufacture of coke, refined petroleum products and nuclear fuel	-0.686	-0.213	0.473	143,481	0.2300	0.209	0.008				
14	Other mining and quarrying	0.060	0.157**	0.098	99,726	0.1990	0.188	0.007				
45	Construction	-0.033	0.021*	0.054**	2,277,089	0.2219	0.185	0.023				
37	Recycling	0.223	0.292**	0.069	15,015	0.4281	0.178	0.018				
90	Sewage and refuse disposal, sanitation and similar activities	0.073	-0.038	-0.111	211,355	0.0496	0.147	0.022				
20	Manufacture of wood and wood products	-0.126	-0.058	0.069	364,452	0.1939	0.133	0.009				
5	Fishing	-0.182	-0.177*	0.004	20,840	0.0578	0.122	0.036				
1	Agriculture	0.004	0.045*	0.042**	1,347,357	0.1391	0.103	0.008				
2	Forestry	0.034	0.033	-0.001	122,164	0.0409	0.082	0.018				

Note: Each row represents a unique individual-level regression as in equation (1.2) for each sector. All specifications include annual time dummies, individual, and establishment fixed effects. ** denotes significance at 1 percent level; * denotes significance at 5 percent level. Robust standard errors are clustered at the establishment-level. See section 1.5 for other independent variables included in the estimation (not reported here). The skill-intensity of the sector is defined as the share of the workforce with a high school or college education. The foreign presence share in an establishment is defined as the number of MNE-to-non-MNE switchers as a share of the establishment workforce.
Source: RAIS, 1996-2001.

and statistically significantly associated with an incumbent domestic worker's wages.

There is considerable variation in the magnitude of the wage spillovers from multinational establishments depending on the sector under consideration. Among the highest skill quintile, only the education sector exhibits a statistically significant positive correlation between the multinational presence in the establishment and incumbent workers' wages. For incumbent workers in this sector, a one-percentage point increase in the share of former multinational-establishment workers, all else equal, increases wages by 0.2 percent.

Positive multinational spillovers are not specific to the services sector where much of the foreign investment flowed since 1996. Workers in the radio and television equipment manufacturing sector also experience wage increases of 0.4 percent with an increase of one percentage-point in the proportion of former MNE workers in the establishment, all else equal. Though multinational spillovers are not economy-wide, and in fact, most sectors and most workers do not receive spillover benefits, the results are consistent with the idea that local conditions, such as the level of education and industry characteristics, may play an important role in the ability of a country to absorb the positive effects of foreign investment.

Figure 1.2 displays the results from table 1.10. Each bar represents a single sector, ranked from left to right, in order of decreasing skill-intensity, as defined by the share of workers with at least a high-school education. At the very left, for instance, is the financial intermediation sector where 91.9 percent of the workforce is high-school educated. At the right end, by contrast, is the forestry sector, with only 8.2 percent of workers holding a high-school degree. The figure also displays the coefficient on multinational spillovers ($\gamma_M - \gamma_D$) for each sector and demonstrates that multinational spillovers decline with sector skill-intensity. Though all sectors do not benefit from multinational knowledge spillovers, high-skilled sectors, on average, benefit more from the presence of former multinational-establishment workers.

Table 1.12 reinforces the idea that workers in high-skilled sectors receive larger spillovers from the presence of former multinational-establishment workers in the sector than do low-skilled sectors. Columns (1)-(4) replicate the results from table 1.9. In column (5), I report coefficients from the regression in which the share of workers with

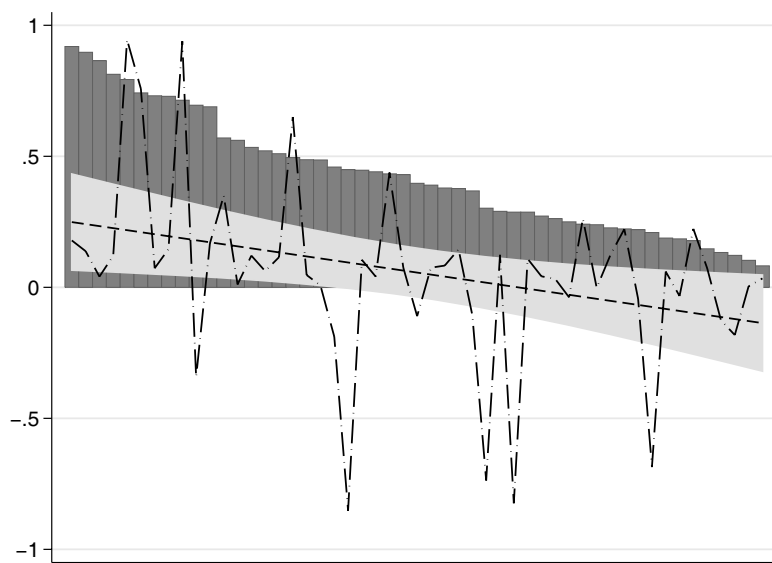


Figure 1.2: Multinational Spillovers, by Sector Skill-Intensity, 1996-2001

Table 1.12: Multinational Spillovers, 1996-2001

Dep. Variable: Log Annual Wages	(1)	(2)	(3)	(4)	(5)
$\gamma_M - \gamma_D$	0.977**	1.071**	-0.025	0.075**	-0.043
<i>F</i> -statistic	15.29	75.87	1.00	10.38	0.87
<i>p</i> -value	0.0001	0.0000	0.3183	0.0013	0.3506
$(\gamma_M - \gamma_D) * \text{Sector Skill-Intensity}$					0.332**
<i>F</i> -statistic					7.56
<i>p</i> -value					0.0060
Sector Skill-Intensity					-0.024
Robust Standard Error					(0.016)
Individual Fixed Effects	NO	NO	NO	YES	YES
Establishment Fixed Effects	NO	NO	YES	YES	YES
Time Fixed Effects	NO	YES	YES	YES	YES
Sector Skill-Intensity Interaction	NO	NO	NO	NO	YES
Number of Observations	450,842	2,634,947	2,634,947	2,634,947	2,629,404
Overall R-squared	0.5483	0.5403	0.3948	0.2658	0.5181

Note: Robust standard errors, clustered at the establishment-level, are in parentheses. ** denotes significance at 1 percent level; * denotes significance at 5 percent level. See section 1.5 for other independent variables included in the estimation (not reported here).

Source: RAIS, 10 percent random sample, 1996-2001.

experience at a multinational-establishment (S_{jt}^M) and the share of workers hired from another domestic-owned establishment (S_{jt}^D) are interacted with the skill-intensity of the

establishment's sector. The results fail to reject that the marginal effect of the share of former multinational-establishment workers in the domestic-owned establishment, controlling for periods of establishment hiring, increases when the sector skill-intensity is higher.

1.6 Multinational Spillovers By Worker Skill-Level

Results in the previous sections suggest that skill-levels and the absorptive capacity of a sector play a role in a sector's ability to absorb a multinational's technological capital. In this section, I ask: are higher-skilled switcher workers better able to *convey* the MNE's technology to other workers, just as higher-skilled incumbent domestic workers may be better able to *absorb* the MNE's technology from the switchers? Similarly, the analysis assumes that a worker learns while at the multinational establishment. Therefore, the longer a switcher worker is employed at the multinational establishment before displacement, the greater the potential information to absorb and transfer. For this reason, I define the skill-level of the worker along three separate dimensions: the worker's educational attainment, the worker's skill-intensity of occupation, and the worker's tenure at the establishment. I use tenure at the previous establishment for switcher workers and current tenure at the establishment for incumbent domestic workers. The analysis returns to the ten percent random sample of the incumbent domestic workforce drawn across all sectors from section 1.5.1.²⁴

1.6.1 Switcher skill-level

I augment equation (1.2) to include the share of the domestic establishment's workforce trained and displaced from a foreign-owned establishment *and* of a specific skill-

²⁴In an appendix available by request, I explore in greater detail how spillovers are transferred and absorbed in the sectors where spillovers exist. I call the sectors with positive and significant multinational knowledge spillovers in section 1.5.2 the "high absorptive capacity sectors."

level as follows:

$$\begin{aligned}
\ln y_{ijt} = & \gamma_{M_{prim}} S_{jt}^{M_{prim}} + \gamma_{M_{high}} S_{jt}^{M_{high}} + \gamma_{M_{grad}} S_{jt}^{M_{grad}} \\
& + \gamma_{D_{prim}} S_{jt}^{D_{prim}} + \gamma_{D_{high}} S_{jt}^{D_{high}} + \gamma_{D_{grad}} S_{jt}^{D_{grad}} \\
& + \psi_i + \lambda_{j(i)} + \delta_t + \beta_1 X_{it} + \beta_2 Z_{jt} + \epsilon_{ijt},
\end{aligned} \tag{1.3}$$

where the subscripts (*prim, high, grad*) signify primary school, high school, and college graduate, respectively. To be clear that it is the skill-level of the former multinational-establishment workers and not simply that these workers are disproportionately higher-skilled than the non-MNE switcher workers, I also include the share of non-MNE switchers by skill-level.

The top panel of table 1.13 reports the results by the education level of the switcher worker. The results are consistent with the hypothesis that higher-skilled former multinational-establishment workers are better able to transfer information to the incumbent domestic workforce. A one percentage point increase in the share of former multinational-establishment workers with a college education increases wages of the incumbent domestic workforce by 0.3 percent. Though the results for MNE-switcher workers with a high school and primary school education are not statistically different from the results for non-MNE switcher workers with similar education levels, the point estimates are monotonically increasing with education.

The middle panel of table 1.13 reports results by the MNE and non-MNE switcher worker's skill-level, as defined by the skill-intensity of occupation according to the following regression:

$$\begin{aligned}
\ln y_{ijt} = & \gamma_{M_{unskb}} S_{jt}^{M_{unskb}} + \gamma_{M_{skb}} S_{jt}^{M_{skb}} + \gamma_{M_{whit}} S_{jt}^{M_{whit}} + \gamma_{M_{prof}} S_{jt}^{M_{prof}} \\
& + \gamma_{D_{unskb}} S_{jt}^{D_{unskb}} + \gamma_{D_{skb}} S_{jt}^{D_{skb}} + \gamma_{D_{whit}} S_{jt}^{D_{whit}} + \gamma_{D_{prof}} S_{jt}^{D_{prof}} \\
& + \psi_i + \lambda_{j(i)} + \delta_t + \beta_1 X_{it} + \beta_2 Z_{jt} + \epsilon_{ijt},
\end{aligned} \tag{1.4}$$

where the subscripts (*unskb, skb, whit, prof*) signify unskilled blue collar, skilled blue collar, other white collar, and professional worker, respectively. The results follow the same pattern as the results for skill as measured by educational attainment. A one per-

Table 1.13: Multinational Spillovers, By Switcher Skill-Level, 1996-2001

Dep. Variable: Log Annual Wages	
Education	
Primary School ($\gamma_{M_{prim}} - \gamma_{D_{prim}}$)	0.039
<i>F-statistic</i>	2.10
<i>p-value</i>	0.1476
High School ($\gamma_{M_{high}} - \gamma_{D_{high}}$)	0.046
<i>F-statistic</i>	1.15
<i>p-value</i>	0.2845
College Graduate ($\gamma_{M_{grad}} - \gamma_{D_{grad}}$)	0.303**
<i>F-statistic</i>	14.78
<i>p-value</i>	0.0001
Number of Observations	2,634,947
Overall R-squared	0.2663
Occupation	
Unskilled Blue Collar ($\gamma_{M_{unskb}} - \gamma_{D_{unskb}}$)	-0.092
<i>F-statistic</i>	2.77
<i>p-value</i>	0.0963
Skilled Blue Collar ($\gamma_{M_{skb}} - \gamma_{D_{skb}}$)	0.025
<i>F-statistic</i>	0.59
<i>p-value</i>	0.4429
Other White Collar ($\gamma_{M_{whit}} - \gamma_{D_{whit}}$)	0.071
<i>F-statistic</i>	1.11
<i>p-value</i>	0.2927
Professional & Technical ($\gamma_{M_{prof}} - \gamma_{D_{prof}}$)	0.243**
<i>F-statistic</i>	30.55
<i>p-value</i>	0.0000
Number of Observations	2,634,947
Overall R-squared	0.2662
Tenure	
Lowest Quartile Tenure ($\gamma_{M_{tenlow}} - \gamma_{D_{tenlow}}$)	0.073
<i>F-statistic</i>	3.15
<i>p-value</i>	0.0759
Second Quartile Tenure ($\gamma_{M_{tenmlow}} - \gamma_{D_{tenmlow}}$)	0.073
<i>F-statistic</i>	2.78
<i>p-value</i>	0.0957
Third Quartile Tenure ($\gamma_{M_{tenmhigh}} - \gamma_{D_{tenmhigh}}$)	0.125**
<i>F-statistic</i>	8.56
<i>p-value</i>	0.0034
Highest Quartile Tenure ($\gamma_{M_{tenhigh}} - \gamma_{D_{tenhigh}}$)	0.028
<i>F-statistic</i>	0.32
<i>p-value</i>	0.5694
Number of Observations	2,634,947
Overall R-squared	0.2659

Note: All specifications include annual time dummies, individual, and establishment fixed effects. Robust standard errors are clustered at the establishment-level. ** denotes significance at 1 percent level; * denotes significance at 5 percent level. See section 1.5 for other independent variables included in the estimation (not reported here).

Source: RAIS, 10 percent random sample, 1996-2001.

centage point increase in the share of former multinational-establishment workers in a professional or technical occupation increases wages of the incumbent domestic workforce by 0.2 percent. The coefficient estimates for the lower skilled occupations are statistically insignificant.

The bottom panel of table 1.13 reports results by the MNE and non-MNE switcher worker's skill-level, as defined by the worker's tenure at the previous establishment according to the following regression:

$$\begin{aligned} \ln y_{ijt} = & \gamma_{M_{tenlow}} S_{jt}^{M_{tenlow}} + \gamma_{M_{tenmlow}} S_{jt}^{M_{tenmlow}} + \gamma_{M_{tenmhigh}} S_{jt}^{M_{tenmhigh}} + \gamma_{M_{tenhigh}} S_{jt}^{M_{tenhigh}} \\ & + \gamma_{D_{tenlow}} S_{jt}^{D_{tenlow}} + \gamma_{D_{tenmlow}} S_{jt}^{D_{tenmlow}} + \gamma_{D_{tenmhigh}} S_{jt}^{D_{tenmhigh}} + \gamma_{D_{tenhigh}} S_{jt}^{D_{tenhigh}} \\ & + \psi_i + \lambda_{j(i)} + \delta_t + \beta_1 X_{it} + \beta_2 Z_{jt} + \epsilon_{ijt}, \end{aligned} \quad (1.5)$$

where the subscripts (*tenlow*, *tenmlow*, *tenmhigh*, *tenhigh*) signify switcher workers with experience at the previous establishment in the lowest quartile, second quartile, third quartile, and highest quartile, respectively.²⁵ The results largely confirm the hypothesis that the longer the MNE-switcher worker is employed at the multinational establishment, the better able is the worker to transfer information to the incumbent domestic workforce in the form of higher wages. An increase in the share of workers with at least a year of experience at a multinational establishment significantly increases incumbent domestic workers' wages. Interestingly, workers with the most experience at multinational establishments do not differentially impact wages for workers in the domestic-owned establishment.

Together, the results from table 1.13 offer evidence that higher skilled former multinational-establishment workers are better able to transfer information to the incumbent domestic workforce. An increase in the share of MNE-switchers with a college education, in a professional occupation, and with experience at the multinational establishment between one and four years increases wages of incumbent domestic workers at domestic-owned establishments.

²⁵The median tenure is approximately 1 year.

Table 1.14: Multinational Spillovers, By Incumbent Skill-Level, 1996-2001

Dep. Variable: Log Annual Wages	
Education	
<i>Incumbents with Primary School</i>	
$\gamma_M - \gamma_D$	0.027
<i>F-statistic</i>	1.14
<i>p-value</i>	0.2858
Number of Observations	1,690,010
Overall R-squared	0.2087
<i>Incumbents with High School</i>	
$\gamma_M - \gamma_D$	0.098*
<i>F-statistic</i>	5.48
<i>p-value</i>	0.0192
Number of Observations	701,222
Overall R-squared	0.2417
<i>Incumbents with College Degree</i>	
$\gamma_M - \gamma_D$	0.162
<i>F-statistic</i>	2.44
<i>p-value</i>	0.1183
Number of Observations	243,715
Overall R-squared	0.2773

Note: All specifications include annual time dummies, individual, and establishment fixed effects. Robust standard errors are clustered at the establishment-level. ** denotes significance at 1 percent level; * denotes significance at 5 percent level. See section 1.5 for other independent variables included in the estimation (not reported here).

Source: RAIS, 10 percent random sample, 1996-2001.

1.6.2 Incumbent skill-level

Tables 1.14, 1.15, and 1.16 report results from augmented equations (1.2) in which I restrict the set of observations for analysis to only those incumbent domestic workers with a given skill-level, as defined by the incumbent worker's educational attainment, skill-intensity of occupation, and tenure at the domestic-owned establishment.

Table 1.14 reports results from these regressions when educational attainment is used to measure the skill-level of the incumbent domestic worker. The results fail to reject the hypothesis that higher-skilled incumbent domestic workers are better able to absorb information from MNE-switchers. A one percentage point increase in the share of former multinational-establishment workers in the domestic-owned establishment increases wages for incumbents with a high school education by 0.1 percent. Though the

Table 1.15: Multinational Spillovers, By Incumbent Skill-Level, 1996-2001

Dep. Variable: Log Annual Wages	
Occupation	
<i>Unskilled Blue Collar Incumbents</i>	
$\gamma_M - \gamma_D$	0.007
<i>F-statistic</i>	0.01
<i>p-value</i>	0.9070
Number of Observations	323,866
Overall R-squared	0.0982
<i>Skilled Blue Collar Incumbents</i>	
$\gamma_M - \gamma_D$	0.073*
<i>F-statistic</i>	4.41
<i>p-value</i>	0.0356
Number of Observations	1,119,308
Overall R-squared	0.2064
<i>Other White Collar Incumbents</i>	
$\gamma_M - \gamma_D$	0.083
<i>F-statistic</i>	2.62
<i>p-value</i>	0.1056
Number of Observations	433,308
Overall R-squared	0.2494
<i>Professional & Technical Incumbents</i>	
$\gamma_M - \gamma_D$	0.069
<i>F-statistic</i>	3.00
<i>p-value</i>	0.0832
Number of Observations	714,862
Overall R-squared	0.3238

Note: All specifications include annual time dummies, individual, and establishment fixed effects. Robust standard errors are clustered at the establishment-level. ** denotes significance at 1 percent level; * denotes significance at 5 percent level. See section 1.5 for other independent variables included in the estimation (not reported here).

Source: RAIS, 10 percent random sample, 1996-2001.

estimate for college-educated workers is weakly significant, the point estimates increase monotonically with education, as would be expected.

The results for incumbent skill-levels measured by the skill-intensity of occupation, reported in table 1.15, also present weak evidence in favor of the hypothesis that higher-skilled incumbent domestic workers are better able to absorb information from former multinational-establishment workers. There is no statistical evidence that increasing the share of former multinational-establishment workers increases the wages of unskilled

Table 1.16: Multinational Spillovers, By Incumbent Skill-Level, 1996-2001

Dep. Variable: Log Annual Wages	
Tenure	
<i>Lowest-Tenure Incumbents</i>	
$\gamma_M - \gamma_D$	0.172
<i>F-statistic</i>	0.93
<i>p-value</i>	0.3340
Number of Observations	658,519
Overall R-squared	0.0987
<i>Second Quartile Tenure Incumbents</i>	
$\gamma_M - \gamma_D$	0.059
<i>F-statistic</i>	0.74
<i>p-value</i>	0.3898
Number of Observations	659,809
Overall R-squared	0.1132
<i>Third Quartile Tenure Incumbents</i>	
$\gamma_M - \gamma_D$	0.095
<i>F-statistic</i>	3.40
<i>p-value</i>	0.0652
Number of Observations	660,924
Overall R-squared	0.0896
<i>Highest-Tenure Incumbents</i>	
$\gamma_M - \gamma_D$	0.013
<i>F-statistic</i>	0.05
<i>p-value</i>	0.8174
Number of Observations	655,695
Overall R-squared	0.1399

Note: All specifications include annual time dummies, individual, and establishment fixed effects. Robust standard errors are clustered at the establishment-level. ** denotes significance at 1 percent level; * denotes significance at 5 percent level. See section 1.5 for other independent variables included in the estimation (not reported here).

Source: RAIS, 10 percent random sample, 1996-2001.

blue collar workers. However, skilled blue collar workers benefit from the increased presence of former multinational-establishment workers—a one percentage point increase in the share of former multinational-establishment workers increases wages for skilled blue collar incumbents by 0.1 percent. Similarly, with weak significance, the highest skilled workers (those with other white collar and professional occupations) benefit from an increased presence of former multinational-establishment workers.

The results for incumbent domestic workers with skill-levels measured by the worker's

experience at the domestic-owned establishment, reported in table 1.16, are similarly suggestive. Relying on a 95 percent confidence interval does not provide much support, however weakly significant point estimates suggest that incumbents with two to six years of experience at the domestic-owned establishment are most likely to benefit from an increased foreign presence in the establishment. In addition, the high point-estimate for the least-experienced incumbent workers may suggest that new workers are better at learning the newest technologies.

1.6.3 Knowledge matching and knowledge spillovers

Jovanovic and Rob (1989) argue that informational spillovers will be greater the larger the *knowledge distance* between the agents, that is the greater the informational asymmetry between the agents, while Moretti (2004) finds human capital spillovers are greater for industries that are *economically close* than for industries that are *economically distant*. In this section, I use these two contrasting ideas to test the hypothesis that spillovers occur between *like* workers versus the hypotheses that spillovers occur between *unlike* workers. That is, I ask the following question: Do the magnitude of spillovers increase as the likelihood increases that the entering displaced multinational-establishment worker is similar in his skill set to the incumbent domestic worker? Do managers learn from managers and production workers learn from production workers? Or do production workers learn best from managers?

Table 1.17 reports results for the analysis of equation (1.3), where observations are restricted by the skill-level of the incumbent domestic worker for the three educational attainment groupings. If information is best transferred between *like*-groups of workers, I expect to see the largest positive and significant coefficients in the top row for the first panel (the effects of switcher workers with primary school on incumbents with primary school), the second row in the middle panel (the effects of switcher workers with high school on incumbents with high school), and the third row (the effects of switcher workers with a college degree on incumbents with a college degree). If information is best transferred between *different* workers, the data would show positive and significant coefficients for college graduate switchers when interacting with primary school incumbents, and vice versa. For the middle panel, high school incumbents should benefit most

when interacting with college graduate switchers.

The data suggest that information is best transferred between similarly-skilled groups of high-skilled workers and from higher skilled former multinational-establishment workers to lower-skilled incumbent domestic workers. A one percentage point increase in the share of former multinational-establishment workers with a college degree increases wages for incumbent domestic workers with a high school education by 0.28 percent. A similar increase in the share of former multinational-establishment workers with a college degree would increase wages for incumbent domestic workers with a college degree by 0.30 percent.

Results for skill-intensity of occupation groupings and experience groupings are available from the author by request. Largely consistent with the evidence presented in table 1.17, results for the occupational groupings suggest that skilled blue collar, other white collar, and professional incumbents learn from professional former-multinational establishment workers. Skilled blue collar workers also benefit from an increased presence of skilled blue collar MNE-switchers. The evidence from the experience groupings offer support for the idea that new workers are best able to absorb new technology. An increase in the share of experienced MNE-switchers (those workers with a tenure at the multinational establishment between one and four years) is positively-associated with increased wages for the least-experienced incumbents. Experienced MNE-switchers also benefit incumbent workers with some experience.

1.7 Robustness Checks

The key identifying assumption in (1.2), after controlling for individual, establishment, and time fixed effects, time-varying individual-specific characteristics and time-varying establishment-specific characteristics, and general hiring trends, is that ϵ_{ijt} is uncorrelated with the main variable of interest, S_{jt}^M . Any positive correlation between the share of former multinational-establishment workers in the domestic-owned establishment and the error term will lead to upwardly biased estimates. Potential threats to this identification are 1) time-varying, productivity shocks to establishments that cause establishments to seek out former multinational-establishment workers in the unem-

Table 1.17: Multinational Spillovers, By Switcher*Incumbent Skill-Level, 1996-2001

Dep. Variable: Log Annual Wages	
Incumbent with Primary School	
Primary School ($\gamma_{M_{prim}} - \gamma_{D_{prim}}$)	0.047
<i>F-statistic</i>	2.28
<i>p-value</i>	0.1307
High School ($\gamma_{M_{high}} - \gamma_{D_{prim}}$)	-0.018
<i>F-statistic</i>	0.10
<i>p-value</i>	0.7566
College Graduate ($\gamma_{M_{grad}} - \gamma_{D_{grad}}$)	0.022
<i>F-statistic</i>	0.03
<i>p-value</i>	0.8696
Number of Observations	1,690,010
Overall R-squared	0.2087
Incumbent with High School	
Primary School ($\gamma_{M_{prim}} - \gamma_{D_{prim}}$)	0.043
<i>F-statistic</i>	0.55
<i>p-value</i>	0.4580
High School ($\gamma_{M_{high}} - \gamma_{D_{high}}$)	0.062
<i>F-statistic</i>	0.90
<i>p-value</i>	0.3417
College Graduate ($\gamma_{M_{grad}} - \gamma_{D_{grad}}$)	0.283**
<i>F-statistic</i>	6.80
<i>p-value</i>	0.0091
Number of Observations	701,222
Overall R-squared	0.2422
Incumbent with College Degree	
Primary School ($\gamma_{M_{prim}} - \gamma_{D_{prim}}$)	0.263
<i>F-statistic</i>	2.08
<i>p-value</i>	0.1496
High School ($\gamma_{M_{high}} - \gamma_{D_{high}}$)	-0.146
<i>F-statistic</i>	0.52
<i>p-value</i>	0.4698
College Graduate ($\gamma_{M_{grad}} - \gamma_{D_{grad}}$)	0.307*
<i>F-statistic</i>	3.99
<i>p-value</i>	0.0459
Number of Observations	243,715
Overall R-squared	0.2787

Note: All specifications include annual time dummies, individual, and establishment fixed effects. Robust standard errors are clustered at the establishment-level. ** denotes significance at 1 percent level; * denotes significance at 5 percent level. See section 1.5 for other independent variables included in the estimation (not reported here).

Source: RAIS, 10 percent random sample, 1996-2001.

ployed labor force and 2) switcher workers who sort into high wage establishments. I assess the plausibility of each of these concerns in turn.

Establishment-Level, Time-Varying Productivity Shocks Suppose domestic-owned establishment j experiences a positive productivity shock in time t . Suppose further this positive productivity shock causes the establishment disproportionately seek out former multinational-establishment workers, as opposed to non-MNE switcher workers, in the unemployed labor force with the intention of upgrading the skill-level of the workforce. This would violate the exogeneity assumption that $(E(S_{jt}^M * \epsilon_{ijt}) = 0)$.

As a test for the existence of this plausible unobservable establishment-level, time-varying shock correlated with S_{jt}^M , I include the future value of the foreign presence share into the analysis. More precisely, if S_{jt}^M is correlated with ϵ_{ijt} due to time-varying, establishment-level shocks to productivity, and moreover, these shocks to productivity lead the establishment to skill-upgrade by hiring former multinational-establishment workers, controlling for S_{jt+1}^M in equation (1.2) should capture this shock. However, it is the differential increase in former multinational-establishment worker hiring that is important to the estimation, so I include the future value of S_{jt}^D . I augment equation (1.2) as follows:

$$\begin{aligned} \ln y_{ijt} = & \gamma_{M_t} S_{jt}^M + \gamma_{M_{t+1}} S_{jt+1}^M + \gamma_{D_t} S_{jt}^D + \gamma_{D_{t+1}} S_{jt+1}^D \\ & + \psi_i + \lambda_{j(i)} + \delta_t + \beta_1 X_{it} + \beta_2 Z_{jt} + \epsilon_{ijt}. \end{aligned} \quad (1.6)$$

Establishment-level skill-upgrading productivity shocks will overturn my results if $\gamma_{M_{t+1}} - \gamma_{D_{t+1}}$ is positive and significant, meanwhile $\gamma_{M_t} - \gamma_{D_t}$ is statistically insignificant.

Switcher Worker Sorting Suppose the unemployed stock of former multinational establishment workers in their decision where to accept reemployment choose establishments with higher expected future wages. In this case, S_{jt}^M is endogenous to the worker's wage and there is a simultaneous equations-feedback problem. If all unemployed workers, former multinational-establishment and domestic-owned establishment alike, equally sort to high expected wage establishments, then my control, S_{jt}^D , for the non-MNE switcher share should account for this problem. However, if former multinational-establishment workers are better at distinguishing high wage establishments, then the results are again upwardly biased.

Table 1.18: Robustness Checks, 1996-2001

Dep. Variable: Log Annual Wages	(1)	(2)	(3)
$\gamma_{M_{t-1}} - \gamma_{D_{t-1}}$			0.041
F-statistic			2.01
p-value			0.1561
$\gamma_{M_t} - \gamma_{D_t}$	0.051*	0.045	0.052*
F-statistic	4.56	3.03	3.87
p-value	0.0327	0.0817	0.0492
$\gamma_{M_{t+1}} - \gamma_{D_{t+1}}$		-0.006	
F-statistic		0.07	
p-value		0.7875	
Number of Observations	608,057	608,057	608,057
Overall R-squared	0.4584	0.5072	0.5217

Note: All specifications include annual time dummies, individual, and establishment fixed effects. Robust standard errors are clustered at the establishment-level. ** denotes significance at 1 percent level; * denotes significance at 5 percent level. See section 1.5 for other independent variables included in the estimation (not reported here).

Source: RAIS, 1996-2001.

I consider this issue by including as an additional control the future value of establishment-average wages into equation (1.6) as follows:²⁶

$$\ln y_{ijt} = \gamma_{M_t} S_{jt}^M + \gamma_{M_{t+1}} S_{jt+1}^M + \gamma_{D_t} S_{jt}^D + \gamma_{D_{t+1}} S_{jt+1}^D + \beta_{\bar{y}_{.jt}} \ln \bar{y}_{.jt} + \beta_{\bar{y}_{.jt+1}} \ln \bar{y}_{.jt+1} + \psi_i + \lambda_{j(i)} + \delta_t + \beta_1 X_{it} + \beta_2 Z_{jt} + \epsilon_{ijt}. \quad (1.7)$$

If former multinational-establishment workers sort for expected future wages in establishments, $\gamma_{M_t} - \gamma_{D_t}$ will be statistically indistinguishable from zero.

Table 1.18 presents results from equation (1.7) with the future values for the share of former multinational-establishment workers, non-MNE switcher workers, and establishment-average wages included in the regression, in order to test the robustness of the multinational spillovers results to both unobservable, establishment-level, time-varying productivity shocks and MNE switcher worker sorting. I restrict the sample of incumbent domestic workers to be the same throughout the analysis. Column (1) provides the baseline result for comparison.²⁷

²⁶In section 1.5.1, I demonstrated that the inclusion of $\ln \bar{y}_{.t}$ among the vector of regressors in Z_{jt} does not affect the main results.

²⁷While directly comparable to column (5) in table 1.9, the differences in the coefficients reflect the restricted sample.

In Column (2), I present results from (1.7).²⁸ The coefficient of interest on $\gamma_{M_t} - \gamma_{D_t}$ remains weakly significant, while $\gamma_{M_{t+1}} - \gamma_{D_{t+1}}$ is strongly insignificant and negative. In general, the inclusion of the additional controls for future values fail to find evidence of establishment-level, productivity shocks or switcher worker sorting.

Learning over Time In a related issue, I consider briefly how knowledge spillovers may change over time. Until now, the implicit assumption in the analysis has been that increases in an establishment's foreign presence share are reflected instantaneously in incumbent worker's wages. While this assumption is compelling (e.g., if an MNE-switcher worker employs a new piece of technological capital or a new production process which increases the establishment's profits), there is also reason to believe that some period of time may elapse before learning can translate into earnings (e.g., if an MNE-switcher worker transfers individual-specific human capital to an incumbent domestic worker).

Column (3) of table 1.18 reports the results from an equation relating contemporaneous and lagged values of the foreign presence share, as well as establishment-average wages, to incumbent workers' wages. Under the hypothesis that learning occurs over time, the share of MNE-switchers in the establishment last period should be positively-associated with incumbent domestic workers' wages this period. While the lagged multinational spillover effect, controlling for other domestic hiring, is comparable to the contemporaneous multinational spillover effect, the results fail to support significant learning over time.

1.8 Conclusion

The goal of this chapter was to investigate the impact of foreign direct investment in Brazil on the local labor market through worker mobility and knowledge transmission. Though anecdotal evidence suggests informational externalities may be created by the movement of workers who have been trained by multinational establishments into jobs outside those establishments, thus allowing the benefits of the training to spill to agents outside the MNE, empirically identifying these effects has been difficult. This chapter

²⁸Results for average establishment wages are suppressed.

offers the first direct evidence from a large database on a developing country for positive multinational wage spillovers through worker turnover.

The main results are consistent with the existence of positive multinational spillovers defined to be the effects of the share of former multinational-establishment workers in the domestic-owned establishment on domestic workers' wages. The results are robust to individual and establishment fixed effects, and to different specifications controlling for time-varying, establishment-specific productivity shocks, worker sorting, and the endogeneity of worker displacement. The magnitude of wage spillovers from multinational establishments depends on the sector under consideration. Though multinational spillovers are not economy-wide, and in fact, most sectors and most workers do not receive spillover benefits, the results are consistent with the idea that local conditions, such as the level of education, may play an important role in the ability of a country to absorb the positive effects of foreign investment.

This chapter also distinguishes the multinational spillover effect by the skill-level of the displaced former multinational-establishment worker and the incumbent domestic worker. The results are consistent with the hypothesis that higher-skilled switcher workers are better able to convey the MNE's technology to incumbent domestic workers and higher-skilled incumbent domestic workers are better able to absorb the MNE's technology from switchers, especially in the services sector. Large spillover effects occur when the skill sets of the incumbent domestic worker are lower than the skill sets of the former multinational-establishment worker, suggesting incumbent production workers learn from former multinational managers or technicians.

2

Business Travel as an Input to International Trade

2.1 Introduction

Over the last half-century, tariffs and non-tariff barriers to international trade have fallen considerably around the world as countries join regional and multilateral trading agreements; yet substantial barriers still exist and many countries continue to trade a disproportionate amount intra-nationally.¹ This world of significantly lower trade policy barriers and declining transport costs has shifted the focus of economic research towards more informal border barriers to trade. Based on evidence from a number of studies and a wide range of countries, Anderson and van Wincoop (2004) estimate national borders pose tariff-equivalent barriers of 44 percent. Although national borders are not easily erased, attempts to decrease the costs associated with the borders may help enhance international trade opportunities and increase income levels.²

Border barriers to trade may include language and cultural barriers (e.g., Frankel, Stein and Wei (1998)), currency barriers (e.g., Rose (2003)), security barriers (e.g., Anderson (2000)), and informational barriers (e.g., Portes and Rey (1999)). Business and

¹McCallum (1995) estimates that even after the establishment of the Canada-U.S. Free Trade Agreement (FTA) in 1988, trade between Canadian provinces was more than 20 times the level of trade between Canadian provinces and U.S. states after controlling for distance and size.

²For evidence on the relationship between international trade and income, see Frankel and Romer (1999).

social networks that cross national borders may lessen the impact of these informal trade barriers. In particular, networks may help to provide efficient matches between buyers and sellers, transfer information about the local culture, customs and consumer markets, and provide informal contract enforcement through social sanctioning or blacklisting, where formal contracts are not easily enforced. The importance of networks in generating trade is becoming increasingly recognized in the international economics literature.³ Research has also concluded that networks are less effective at creating trade for homogeneous goods, for which prices can convey the relevant information about the profitability of trading the product, than for differentiated goods, for which a matching of buyers and sellers in characteristics space is necessary (Rauch (1999)).

In view of the existence of informational barriers to trade, it is not surprising that recent research has found that the use of communications tools and the costs of communication have robust associations with bilateral trade. This is the case for bilateral telephone traffic (Portes and Rey (1999)) and the internet (Freund and Weinhold (2004)). In this chapter, I extend the literatures on informational barriers to trade, business and social networks, and communication in trade by studying the impact of bilateral international travel on bilateral international trade. An important way in which people build and maintain networks is through face-to-face meetings. If networks are transnational, these meetings will require international travel. More precisely, this research presents evidence for international business travel as a fixed cost of entry into international markets.

I am, of course, not the first to recognize the importance of international travel for international trade. Frankel (1997) writes: “Consider a kind of export important to the United States: high-tech capital goods. To begin sales in a foreign country may involve many trips by engineers, marketing people, higher ranking executives to clinch a deal, and technical support staff to help install the equipment or to service it when it malfunctions.” In fact, there is already some support in the literature for the idea of international travel as a mechanism to overcome informal barriers to international trade (Kulendran and Wilson (2000) for Australia, and Aradhyula and Tronstad (2003) for the Arizona-Mexico border region.) This chapter, however, offers a number of important

³For a complete survey of the literature on business and social networks in international trade, see Rauch (2001).

contributions to the current literatures on international travel and international trade and communication in international trade, in large part due to the depth of a survey from the U.S. Department of Commerce on all outbound travelers from the United States. First, in a study on how international visits by economists affect their future research productivity, Hamermesh (2006) declares, “with the exception of Kulendran and Wilson (2000), the relationship between international travel and international trade has not been studied...” This is surprising, given the many mechanisms through which trade and travel are linked. Also, this is the first research, to my knowledge, to use this rich international travel data in economics.⁴ Next, I go beyond the previous work to estimate the effects of international travel on international trade using both time-series (Aradhyula and Tronstad (2003) rely only on cross-sectional information.) and cross-section information (Kulendran and Wilson (2000) use only the time series dimension.) to identify a causal relationship between international business travel and international trade. I will further exploit the events surrounding September 11 to control for a potential omitted variable affecting international travel and international trade.

Also, unlike available data on telephone traffic and internet use, the international travel data identifies the traveler’s main purpose of trip as business or leisure, allowing for a deeper exploration of the link between communication and international trade. This distinction allows me to be certain that any positive impact of prior business travel on international trade is not merely a reflection of an omitted variable, leisure travel. I continue to analyze the differential impacts of business travel on export volumes versus export varieties to test the hypothesis that business travel serves as a fixed cost to export a new good to a foreign market.

In addition, I distinguish the effects of business travel by the main language of the trading partner, to investigate further the effects of language communication on business networks in international trade. I also use bilateral travel flows to explore more deeply the hypothesis that trade in differentiated products is more information-intensive than trade in homogeneous products and is therefore more strongly associated with face-to-face meetings. Finally, this research utilizes traveler characteristics, including the traveler’s occupation, to investigate the hypothesis that higher-skilled travelers are better

⁴Tourism researchers use this data frequently. See, for example, Bai, Jang, Cai and O’Leary (2001) and Cai, Lehto and O’Leary (2001).

able to convey information about profitable trading opportunities.

My results have direct implications for policy. By quantifying the extent to which international business travel causes international trade, this study can help to evaluate the many government programs worldwide that promote business travel for the purpose of creating trade. The U.S. government pursues many such export promotion policies. My research can help to evaluate whether these trade missions, grants, and other international trade promotion programs should be expanded or reduced.⁵

Motivated by the Melitz (2003) model of international trade in which only the most productive firms enter into export markets, covering the fixed entry cost, I propose an empirical model in which the fixed costs of entry to a new country market includes international business travel. The model relates last period's business travel to export volumes and varieties, while controlling for last period's leisure travel. I estimate country-level gravity model regressions using data on international travel and international trade flows for the United States with the rest of the world. Specifically, the Office of Travel and Tourism Industries of the U.S. Department of Commerce conducts a survey of travelers from the U.S. on international flights called the *Survey of International Air Travelers* (SIAT). The SIAT includes information on each outbound traveler's country of residence, country of birth, country of citizenship, occupation, main destination, and main purpose of trip. This rich data set has, to my knowledge, never been explored in economics. The international trade data are from the U.S. Census Bureau's *Exports and Imports of Merchandise Trade*. The two data sources are matched by country identifier for the first time in this research.

The findings can be summarized as follows. The main results are consistent with the view that business travel for the purpose of communication acts as a fixed cost to enter into foreign export markets. Ten percent more business travel last year between the U.S. and country j leads to 0.23 percent more export varieties between the U.S. and country j this year. This is the equivalent of 32 new export varieties per country per year. The effect is driven by travel to non-English speaking countries, for which communication with the U.S. by other means may be less effective. Moreover, the effect is stronger for higher-skilled travelers, reflecting an enhanced ability to transfer information about

⁵Please see appendix B.1 for a more detailed description of U.S. Department of Commerce trade missions.

trading opportunities.

The remainder of this chapter is organized as follows. In the next section, I briefly summarize the literature on business and social networks in international trade, paying special attention to studies related to communication and international trade and international travel and international trade. Section 2.3 details the international travel data, the international trade data, and key gravity control variables and section 2.3.4 offers some descriptive figures. In section 2.4, I discuss my empirical methodology and present the results from the analysis alongside. I begin my analysis with the basic gravity model, then refine the results according to the theory outlined in Anderson and van Wincoop (2003) to include terms designed to capture a country's multilateral resistance. The basis for the empirical results controls for additional variation in international trade and travel surrounding the events of September 11. In section 2.5, I distinguish the effects of business travel on international trade by the main language of the trading partner, by product differentiation, and by the skill-level of the traveler. An additional robustness check is provided in section 2.6. The final section concludes with the broader impacts of this research and proposes some implications for economic policy.

2.2 Related Literature

In this section, I provide a brief overview of the literature on business and social networks in international trade⁶, with special attention to those papers dealing with communication and trade. I also review the extant literature on international travel and international trade.

Communication and International Trade Business and social networks in a variety of forms which provide information about profitable trading opportunities have strong empirical support in the literature. Portes and Rey (1999) use annual telephone call traffic data and the number of multinational bank branches to study cross-country informational networks. They argue informational costs to trade play a substantially larger role than transport costs at decreasing bilateral trade volumes. The coefficient on distance in their standard gravity model is dwarfed by the variables representing the in-

⁶For a complete survey of the literature, see Rauch (2001).

formation transmission mechanisms. Their work is reinforced by a recent study by Fink, Mattoo and Neagu (2002) which finds communications costs, arguably a significant element of information costs, negatively impact trade, even after controlling for bilateral telephone traffic. On the contrary, Freund and Weinhold (2004) argue transport costs still outweigh information costs. Using data from the Internet Software Consortium to count the total number of web hosts in each country, the authors find little evidence that the Internet has affected the coefficient on distance in standard gravity models of trade, though an Internet presence in the country does have a positive impact on trade flows. This is consistent with a model in which the Internet reduces sunk-costs of trading rather than informational costs of trading.⁷

Rauch and Trindade (2002) focus on ethnic Chinese business groups worldwide as providing the source of information-sharing, where the strength of the ethnic Chinese network between two countries is defined by the probability that two people selected at random from those countries will both be ethnically Chinese. Their study finds a highly significant and positive effect of ethnic Chinese networks on bilateral trade. Furthermore, the authors confirm the finding in Rauch (1999) that business networks are more effective at generating trade for differentiated goods than for homogeneous goods (those with reference prices).

International Travel and International Trade There is some support for the idea of international travel overcoming informational barriers through business networks to create international trade in the literature. Kulendran and Wilson (2000) investigate the link between international trade and international travel flows between Australia and its four large trading partners: the U.S., Japan, New Zealand, and the United Kingdom using time series econometrics techniques. With quarterly travel data from the Australian Bureau of Statistics separated by purpose of trip, the authors demonstrate business travel Granger-causes total bilateral trade flows between the U.S. and Australia and business travel Granger-causes total imports from the United Kingdom. These results offer some evidence in support of the idea that businessmen from the U.S. and the U.K. travel to Australia to find buyers for their goods or to meet with established contacts about continuing the relationship. In a similar study, Shan and Wilson (2001) use the Chinese

⁷This finding is reinforced by Blum and Goldfarb (2006) who analyze data on Internet activities by U.S. consumers on non-U.S. websites and find that distance matters even online.

economy as a case study to disentangle the causal relationship between international travel and international trade. Using a Granger no-causality test, the authors conclude that there exists two-way causality between trade and travel, which they argue casts doubt on previous single-equation tourism demand forecasting studies.⁸

Using survey data, Aradhyula and Tronstad (2003) estimate an Arizona agribusiness firm's propensity to trade with Mexican border state, Sonora, as a function of whether the proprietor made a business trip to Sonora state. Controlling for the firm's size relative to other firms selling similar products, how long the firm has been in business in Arizona, the importance of geographic diversity for the agricultural product, and the Spanish-speaking skills of the proprietor, the authors find that business travel helped to overcome informational trade barriers along the Arizona-Mexico border, increasing the propensity to trade by up to 51.5 percent.⁹

2.3 Data

My main data source is a quarterly survey of all international outbound travelers from the United States. I match these key characteristics to country-level bilateral trade flows and other complementary country-level data sources to uncover the impact of business travel on international trade.

2.3.1 International travel data

The international travel data come from the U.S. Department of Commerce, International Trade Administration, Office of Travel and Tourism Industries which conducts a quarterly survey of international outbound air travel from the United States, as part of the nation's research on policy issues related to tourism. The *Survey of International Air Travelers* (SIAT) is an individual-level data set consisting of a representative-sample of

⁸A number of studies have also used similar data and techniques to attempt to uncover the relationship between international travel and economic growth (e.g., Gunduz and Hatemi-J (2005) for Turkey, Oh (2005) for Korea, and Kim, Chen and Jang (2006) for Taiwan).

⁹Related work by Hamermesh (2006) focuses on the impact of international travel on research and development, inferring how visits to Australia by economists affected their subsequent productivity.

overseas travelers from the United States in every quarter from 1993 through 2003.¹⁰

The SIAT is the most comprehensive study of people traveling overseas from the United States, including both U.S. residents and residents of other countries. Although all information is collected on the outbound flight, U.S. residents answer questions about their upcoming trip abroad (travelers *from* the U.S.), and overseas-residents answer questions about their recent trip to the United States (travelers *to* the U.S.).

The SIAT data is particularly valuable to this research agenda as it offers variables beyond the available information in many other international travel databases. The main variables of interest are the respondent's main country of destination¹¹ and the main purpose of trip. This chapter will distinguish between *business* travel, as defined by business, professional, convention, conference, or trade show, and *leisure* travel, as defined by leisure, recreation, holiday, sightseeing, visiting friends, or visiting relatives.¹² The SIAT also has information on the respondent's country of residence, country of birth, country of citizenship, and occupation. Furthermore, directional data (travel to and from the United States) similar to international trade import and export statistics allows an additional dimension not available in other travel statistics.

The main advantage of the SIAT is the long history of quarterly bilateral travel flows by main purpose of trip with which I can distinguish between business and leisure travel.¹³ I restrict observations as follows. In order to match the travel characteristics to country-level trade flows, I aggregate the individual-level travel flows within-year by main destination and resident-type. Individual observations are weighted by the individual-level SIAT expansion weight.¹⁴ Finally, I exclude the main destinations

¹⁰For details on individual airline involvement, the sampling, and survey weighting procedures of the SIAT, please see appendix B.2.

¹¹For overseas residents, the main destination is always a U.S. city. The corresponding variable for these travelers is the final international port of debarkation.

¹²The SIAT also includes travel for the purpose of government affairs or military; study or teaching; religion or pilgrimage; health treatment; and other.

¹³Other travel statistics like those in the World Tourism Organization's *Compendium of Tourism Statistics and Yearbook of Tourism Statistics* provide data such as total bilateral travel flows (e.g., how many people traveled between the U.S. and Germany) or total flows of business and leisure travel to a country (e.g., how many people traveled on business or leisure to Germany from any country). With the SIAT, I can identify total flows of business (or leisure) travel between the U.S. and Germany by U.S. residents and overseas residents.

¹⁴For more information on SIAT survey weighting, please see appendix B.2.

of Canada and Mexico.¹⁵ The final data set includes an annual panel of business and leisure travel from 1993 to 2003 for 212 countries by resident-type.

2.3.2 International trade data

Official U.S. export statistics are compiled by the U.S. Bureau of the Census from copies of the Shipper's Export Declarations which are required to be filed with local Customs officials at the time merchandise is exported from the country. Similarly, official U.S. import statistics are compiled from copies of the Customs Service Entry Summary forms which are required to be filed with Customs at the time merchandise is released to the importers. The U.S. Census Bureau's *Exports and Imports of Merchandise Trade* are available monthly for the years 1993 through 2003, by commodity and trading partner country.

The main variables of interest are the trading partner country code, the 10-digit Harmonized System (HS) commodity code, the 4-digit Standard International Trade Classification (SITC) code, the value of exports,¹⁶ and the value of imports.¹⁷ For the purpose of this research, I also define export (import) varieties between the U.S. and country j to be the number of unique 10-digit HS export (import) commodities that flow between the U.S. and country j .

I aggregate the monthly data into annual data by trading partner country for the purpose of matching to the SIAT data's main destination countries. The final data set includes an annual panel of U.S. import and export volumes and varieties from 1993 to 2003 for 214 countries by product differentiation.

¹⁵Excluding Canada and Mexico, I can be certain to have included virtually all international travel from the United States (as would not be true for a country like France, where significant international travel may take place over land).

¹⁶"The f.a.s. (free alongside ship) value is the value of exports at the port of export, based on the transaction price including inland freight, insurance and other charges incurred in placing the merchandise alongside the carrier at the U.S. port of exportation. The value as defined, excludes the cost of loading the merchandise aboard the exporting carrier and also excludes freight, insurance and other charges or transportation costs beyond the port of exportation." U.S. Census Bureau (2003).

¹⁷"The Customs value reflects the value of imports as appraised by the U.S. Customs Service in accordance with the legal requirements of the Tariff Act of 1930 as amended. This value is generally defined as the price actually paid or payable for merchandise when sold for exportation to the United States, excluding U.S. import duties, freight, insurance and other charges incurred in bringing the merchandise to the United States." U.S. Census Bureau (2003).

2.3.3 Traditional gravity controls

Economists have long relied on the gravity model of international trade to help predict trade flows between two countries. For the gravity model estimations, I collect data on country j 's population and gross domestic product (GDP) from the World Bank's *World Development Indicators*. GDP is measured in current U.S. dollar units. Preferential trading arrangements between country j and the United States are flagged with information from the Organization of American States, Foreign Trade System, while economic and trade sanctions by the United States on country j are flagged with information from the U.S. Department of Treasury's, Office of Foreign Assets Control and supplemented with historical information from Malloy (2001). Data on U.S. country sanctions programs are detailed in appendix table B.1. The data on dollarizations with the U.S. dollar, are constructed from two main sources: the U.S. Department of Treasury's, Office of International Affairs, and Glick and Rose (2002).¹⁸

In order to test the hypothesis that business travel serves as a means of communication, I rely on linguist and expert on the English language worldwide, Crystal (2003), for a list of official English-language countries. Finally, I match the Rauch classification of goods from Rauch (1999) to the international trade flows by 4-digit SITC code to test the hypothesis that business travel is more effective at creating trade for differentiated products than for homogeneous goods. I define homogeneous goods to be both goods traded on an organized exchange and goods with a reference price.

2.3.4 Descriptive figures

The international travel, international trade, and key gravity controls are matched by country code to generate an annual panel of 212 countries. The 154 countries in appendix table B.2 that have non-missing data in logs are chosen for the analysis that follows.

Figure 2.1 shows annual international travel flows from the U.S. by main purpose of trip from 1993 to 2003. It is clear that although international travel from the U.S. had steadily increased from 1993 to 2000, international business and leisure travel flows

¹⁸Please contact the author for details on countries with preferential trading arrangements and dollarizations with the United States.

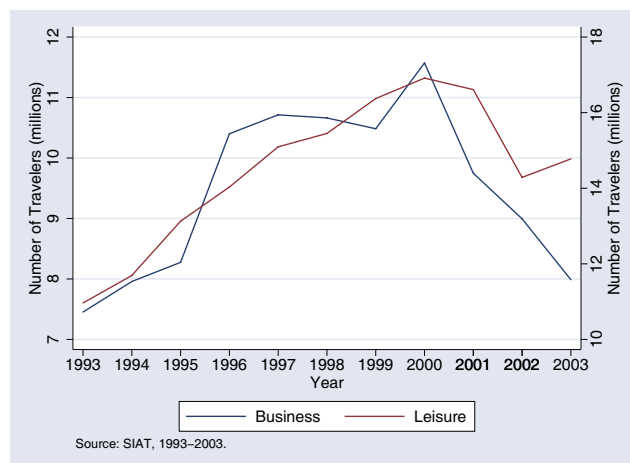


Figure 2.1: International Travel Flows, by Main Purpose of Trip, 1993-2003

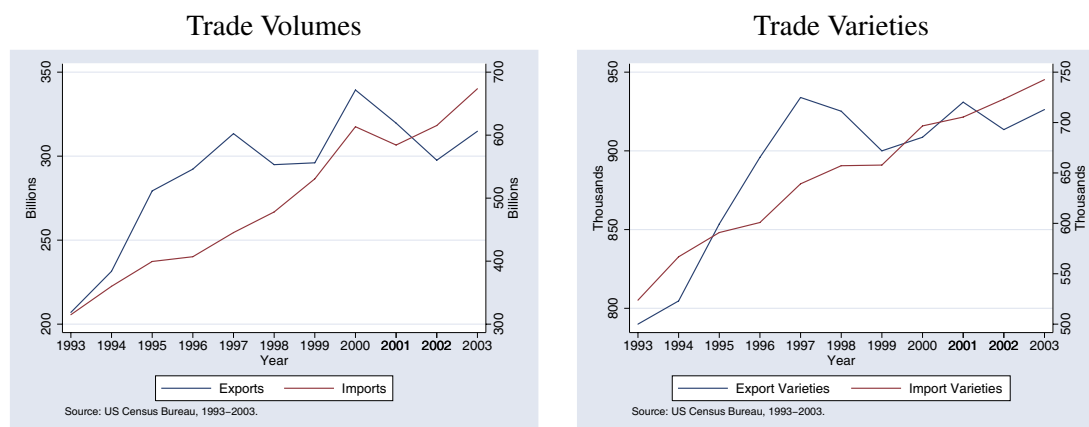


Figure 2.2: International Trade Flows, Volumes and Varieties, 1993-2003

began a steep decline in 2001. International business travel from the U.S. appears somewhat more volatile over the 11-year period, with a relatively small downturn between the years 1997 and 1999, and a far steeper decline beginning in 2001. In 2001, total business travel from the U.S. fell 15.8 percent from the year before, while leisure travel fell only 2.3 percent. By 2003, business travel had fallen to only 70 percent of its level in the year 2000. On the contrary, leisure travel in 2003 had fallen by only 13 percent from the peak in 2000.

Figure 2.2 plots the time path of U.S. trade flows by volume and number of varieties for the years 1993 to 2003. International trade flows also experienced some decline after the year 2000, but these declines were smaller in size and more shortlived as compared to

the steep declines witnessed in the international travel data. U.S. imports were quick to bounce back from the external shock. By 2002, U.S. merchandise imports had returned to pre-2000 levels. Merchandise exports were more severely impacted, but still managed to creep back to 93 percent of 2000 levels by 2003.

Trade volumes may decrease because countries decrease the amount of a commodity they trade or trade volumes may decrease because countries no longer trade that commodity. The right panel of figure 2.2 plots the number of export and import varieties over time. The figure demonstrates that trade varieties (both exports and imports) did not suffer the same fate as trade volumes. Import varieties steadily increased each year post-2000. Though export varieties slowed by 1.9 percent in 2002, the number of export varieties recovered in 2003 by 1.5 percent. During the period when export volumes suffered after the year 2000, it appears that the number of export varieties remained relatively constant, suggesting that the volume per variety must have been falling over this period.

2.4 Empirical Methodology and Estimation

The objective of this chapter is to identify if bilateral business travel acts as a fixed cost to enter new export markets. I estimate country-level gravity regressions relating lagged business travel to international trade, which controls for September 11 as a shock to the variation in international travel and international trade, accounts for the Anderson and van Wincoop (2003) multilateral resistance term, and further accounts for the differential effects of leisure travel.

2.4.1 The basic gravity model

Unlike formal tariff and non-tariff barriers and transportation costs, informal barriers to trade cannot be directly measured and must be inferred through bilateral trade flows. Economists have long relied on the gravity model of international trade to help predict trade flows between two countries. Following the literature, I model factors that influence the flow of trade between countries as multiplicative deviations from a proportional relationship between the bilateral value of trade and the product of the trading partners'

economic sizes as follows:

$$V_{ijt} = \alpha_t \left(\frac{Y_{it} * Y_{jt}}{d_{ijt}} \right), \quad (2.1)$$

where i and j index countries and t indexes time. V_{ijt} represents trade flows between country i and j in time t , and Y_{it} and Y_{jt} are the respective economic sizes of country i and country j in time t . d_{ijt} represents the factors influencing trade between country i and j in time t . In this chapter, I test the effects of business travel to and from the United States on international trade with the United States. For this reason, country i will hereafter be referred to as US .

Anderson and van Wincoop (2003) update the basic gravity model to a general equilibrium framework, accounting for country-level price differentials. That is, how much would the U.S. export to importing country j in time t given price levels in the U.S. and country j at time t . This transforms equation (2.1) into:

$$V_{USjt} = \alpha_t \left(\frac{Y_{USjt}^* * Y_{jt}^*}{d_{USjt}} \right), \quad (2.2)$$

where Y_{USjt}^* and Y_{jt}^* index the complete economic situation in the U.S. and country j at time t . An important contribution of Anderson and van Wincoop's (2003) work is that Y_{USjt}^* and Y_{jt}^* include country-level price indices or "multilateral resistance terms," which depend on a country's complete set of bilateral trade barriers.

The basic model includes a measure of population (POP_{jt}) and per capita GDP ($PCGDP_{jt}$). This captures the tendency for larger (by population) countries to trade less and the tendency for richer countries to be more open to trade. Typically, d_{USjt} will include variables such as distance, common language, colonial links, common border, preferential trading arrangements, trade sanctions, and currency unions.¹⁹ I augment the baseline gravity model specification with the addition of a variable measuring last period's bilateral business travel (BUS_{USjt-1}) in order to test the hypothesis that international sales are produced using prior business travel as a necessary input to trade. By including the lagged value of business travel, the likelihood that the estimation captures any reverse causality is reduced. I also include last period's bilateral leisure travel (LEI_{USjt-1}) to control for general levels of international travel between the U.S. and

¹⁹Because I have excluded Canada and Mexico from the data, no country has a common border with the United States.

country j . Thus, any impact of business travel on international trade is not merely the result of an omitted leisure travel variable.

Log-linearizing equation (2.2) forms the basis for the empirical estimation ahead:

$$\begin{aligned} \ln V_{USjt} = & \ln \alpha_t + \ln Y_{US,t}^* + \ln Y_{jt}^* \\ & + \gamma_1 \ln BUS_{USjt-1} + \gamma_2 \ln LEI_{USjt-1} + \gamma_3 \ln POP_{jt} + \gamma_4 \ln PCGDP_{jt} \\ & + \gamma_5 SAN_{USjt} + u_{USjt}. \end{aligned} \quad (2.3)$$

As there is no country-level variation within the U.S., $\ln \alpha_t$ and $\ln Y_{US,t}^*$ can both be estimated with time fixed effects. In the baseline model, I include country fixed effects to account for the Anderson and van Wincoop (2003) multilateral resistance terms. Because I include country and time fixed effects, variables that do not change over time such as distance or do not change across countries such as U.S. per capita GDP are omitted. I also include a dummy for U.S. economic and trade sanctions on country j in time t (SAN_{USjt}).²⁰ The baseline gravity model specification is as follows:

$$\begin{aligned} \ln V_{USjt} = & \gamma_1 \ln BUS_{USjt-1} + \gamma_2 \ln LEI_{USjt-1} \\ & + \gamma_3 \ln POP_{jt} + \gamma_4 \ln PCGDP_{jt} + \gamma_5 SAN_{USjt} + \phi_j + \delta_t + u_{USjt}, \end{aligned} \quad (2.4)$$

where ϕ_j captures the country-level fixed effects and δ_t captures the time fixed effects and u_{USjt} represents an error term that is assumed to be well-behaved, that is, to exhibit no serial correlation, and to be orthogonal to all regressors. The country-level fixed effects control for any country-specific, unobservable, and time-invariant characteristic that may affect trade with the U.S., such as proximity to the U.S. The time fixed effects control for any time-specific, unobservable, and country-invariant characteristic that may affect trade with the U.S., such as a U.S. recession or boom. The specification in (2.4) implies that identification in this model is based on changes over time in last period's business travel within a country.

The model is tested on three different international trade outcomes: export volumes,

²⁰Intentions to include dummies for preferential trading arrangements between the U.S. and country j at time t and the dollarization of country j at time t proved unidentified when coupled with country fixed effects.

export varieties, and export volumes per variety. If business and social networks are important determinants of international trade through face-to-face meetings, I expect a positive and significant coefficient on the estimate for lagged business travel. More specifically, if business travel is a fixed cost input to establishing a new export market, I expect a positive and significant effect for export varieties. However, as a fixed cost input, business travel should not be required to increase the volume sold of a given variety once that variety exists in a given market. Therefore, I predict a $\gamma_1 > 0$ for export varieties and a γ_1 statistically indistinguishable from zero for export volumes per variety.

2.4.2 Evidence for business networks in international trade

Table 2.1 presents results from the estimation of country-level gravity regressions with country and annual fixed effects, unless otherwise indicated. Panel A reports the results from equation (2.4) for the three different dependent variables: export volumes (EX_{USjt}), export varieties (EV_{USjt}), and export volumes per variety ($\frac{EX}{EV}_{USjt}$).²¹ Although not always significant, the coefficients on the key gravity controls appear in line with the literature.

Ten percent more business travel last year between the U.S. and country j leads to an increase in the volume of exports between the U.S. and country j of approximately 0.34 percent. Based on the average country's business travel with the U.S. in the average year, an increase of approximately 460 business travelers would increase the volume of U.S. exports by approximately \$700,000.

Distinguishing between export varieties and export volumes per variety in this baseline specification, for the purpose of testing the effects of business and social networks on international trade, the results appear inconsistent with the hypothesis that business travel serves as a fixed cost to enter a new market (a statistically insignificant effect of business travel on export varieties). There is also no evidence in this specification that business travel increases export volumes per variety.

The general approach to account for the Anderson and van Wincoop (2003) multi-

²¹Contact the author for results for import volumes (IM_{jUS_t}), import varieties (IV_{jUS_t}), and import volumes per variety ($\frac{IM}{IV}_{jUS_t}$).

Table 2.1: Business Travel and International Trade

Dep. Variable:	Panel A			Panel B			Panel C		
	EX_{USjt}	EV_{USjt}	$\frac{EX}{EV}_{USjt}$	EX_{USjt}	EV_{USjt}	$\frac{EX}{EV}_{USjt}$	EX_{USjt}	EV_{USjt}	$\frac{EX}{EV}_{USjt}$
BUS_{USjt-1}	0.034* (0.015)	0.013 (0.008)	0.022 (0.013)	0.021 (0.016)	0.011 (0.009)	0.010 (0.013)	0.031 (0.018)	0.023** (0.008)	0.007 (0.015)
LEI_{USjt-1}	-0.021 (0.014)	0.0001 (0.007)	-0.021 (0.013)	-0.021 (0.015)	-0.005 (0.007)	-0.016 (0.013)	-0.013 (0.017)	0.001 (0.008)	-0.014 (0.014)
POP_{jt}	0.720** (0.258)	-0.061 (0.162)	0.782** (0.240)	0.437 (1.225)	0.333 (1.109)	0.105 (0.929)	0.912 (1.033)	0.586 (0.789)	0.326 (0.876)
$PCGDP_{jt}$	0.523** (0.081)	0.410** (0.066)	0.113 (0.074)	0.392** (0.115)	0.236** (0.069)	0.156* (0.076)	0.444** (0.113)	0.296** (0.050)	0.148 (0.091)
SAN_{USjt}	0.065 (0.111)	-0.177 (0.086)	0.241** (0.085)	0.184 (0.166)	-0.179 (0.098)	0.362* (0.145)	0.114 (0.192)	-0.196* (0.087)	0.310 (0.170)
Trend				0.046 (0.042)	0.001 (0.035)	0.045 (0.030)	0.029 (0.040)	-0.011 (0.027)	0.041 (0.030)
Year Dummies	X	X	X	X	X	X	X	X	X
Country Dummies	X	X	X	X	X	X	X	X	X
Country Dummies*Trend				X	X	X	X	X	X
Country Dummies*Sept 11 Effect							X	X	X
N	1186	1186	1186	1186	1186	1186	1186	1186	1186
R-squared	0.9780	0.9802	0.9399	0.9835	0.9867	0.9610	0.9900	0.9947	0.9702

Note: Robust standard errors are in parentheses. ** denotes significance at 1 percent level; * denotes significance at 5 percent level.
Sources: SIAT, 1993-2003; U.S. Census Bureau, 1993-2003; World Development Indicators, 1993-2003; Malloy (2001); U.S. Department of the Treasury, Office of Foreign Assets Control.

lateral resistance terms in a panel is to include country dummies interacted with time dummies (Feenstra (2004)). In my setting, however, this would completely wipe out the full set of observations. In order to attempt to control for the time-varying nature of the country-specific price effects, I adapt the baseline specification in equation (2.4) to include country dummies interacted with a linear time trend, as follows:

$$\begin{aligned} \ln V_{USjt} = & \gamma_1 \ln BUS_{USjt-1} + \gamma_2 \ln LEI_{USjt-1} \\ & + \gamma_3 \ln POP_{jt} + \gamma_4 \ln PCGDP_{jt} + \gamma_5 SAN_{USjt} \\ & + \gamma_6 TREND + \phi_j + \phi_j * TREND + \delta_t + u_{USjt}, \end{aligned} \quad (2.5)$$

Panel B of Table 2.1 reports the results for each of the three dependent variables for the specification in equation (2.5). Controlling for time-varying multilateral resistance terms decreases the predictability of the coefficients on lagged business travel. In this specification, lagged business travel with the United States does not help to create trade with the United States.

The main concern in estimating the key coefficient γ_1 in (2.5) is the presence of unobservable shocks to international trade that are correlated with the lagged business travel. The events surrounding September 11 and the aftermath affected both international travel and international trade. Omitting these effects will result in biased estimates of γ_1 .

I define a September 11 indicator equal to 1 for the years 2001, 2002, and 2003. The September 11 indicator is equal to 0 for all other years. Because the September 11 indicator varies only by time, the main effects would be completely absorbed in the annual fixed effects (δ_t) already included in the model. In order to include the September 11 indicator in the model, I interact the indicator with the country-level fixed effects, as follows:

$$\begin{aligned} \ln V_{USjt} = & \gamma_1 \ln BUS_{USjt-1} + \gamma_2 \ln LEI_{USjt-1} \\ & + \gamma_3 \ln POP_{jt} + \gamma_4 \ln PCGDP_{jt} + \gamma_5 SAN_{USjt} \\ & + \gamma_6 TREND + \phi_j + \phi_j * TREND + \phi_j * SEPT11 + \delta_t + u_{USjt}. \end{aligned} \quad (2.6)$$

The country-specific September 11 effect is consistent with U.S. policy in the aftermath of the September 11 attacks. For example, changes in U.S. visa policy targeted men from Arab and Muslim countries. Meanwhile, in the lead up to the wars in Afghanistan and Iraq, many countries received generous sums of foreign aid in return for sharing information and/or otherwise helping the U.S. government. As an example, according to the U.S. Census Bureau's trade data, Jordan received almost \$3 million in "articles donated for relief or charity" during the single month of March 2003. During the same month, Jordan also received large inflows of various forms of "military equipment." In total, U.S. exports to Jordan increased by almost 20 percent from 2001-2002, and by over 20 percent from 2002-2003.²²

This specification allows for the country fixed effects to vary over time in a way that is specifically related to September 11. The identification of this model, however, is still based on changes over time in the effects of lagged business travel within country groups, accounting for the multilateral resistance terms and further accounting for the differential effects of leisure travel.

Panel C of Table 2.1 reports the results from equation (2.6), the basis for the estimation of the empirical results that follow. The positive and significant results in Panel A for the effects of lagged business travel on export volumes and volumes per variety remain insignificantly different from zero as in Panel B. However, when controlling for the impact of September 11, lagged business travel enters as a positive and significant predictor of export varieties. Considering the large flows of military and humanitarian aid to countries like Jordan, it is clear that some increases in export varieties post-September 11 did not require international business travel, and the new control accounts for these post-September 11 changes.

Ten percent more business travel last year between the U.S. and country j leads 0.23 percent more export varieties between the U.S. and country j this year. This is the equivalent of 32 new products exported per country per year. By using the lagged value of business travel, the result accounts for any potential reverse causality from an increase in export varieties to business travel, and further controls for any potential omitted variable bias due to leisure travel. I view this result, coupled with an insignificant result for

²²Other countries with similar patterns in the data include Afghanistan, Qatar, Pakistan, and Turkey.

Table 2.2: Business Travel and International Trade, by Main Language of Trading Partner

Dep. Variable:	English-Speaking			Non-English Speaking		
	EX_{USjt}	EV_{USjt}	$\frac{EX}{EV}_{USjt}$	EX_{USjt}	EV_{USjt}	$\frac{EX}{EV}_{USjt}$
BUS_{USjt-1}	0.031 (0.022)	0.020 (0.012)	0.011 (0.022)	0.030 (0.024)	0.024* (0.010)	0.006 (0.020)
LEI_{USjt-1}	-0.007 (0.027)	-0.001 (0.011)	-0.006 (0.027)	-0.015 (0.020)	0.001 (0.010)	-0.016 (0.017)
POP_{jt}	0.822 (0.426)	0.225 (0.278)	0.597 (0.513)	0.681 (2.038)	0.755 (1.363)	-0.074 (1.630)
$PCGDP_{jt}$	0.294 (0.161)	0.162* (0.066)	0.132 (0.145)	0.482 (0.136)	0.314** (0.058)	0.169 (0.110)
SAN_{USjt}	0.333 (0.202)	0.039 (0.041)	0.294 (0.176)	-0.061 (0.336)	-0.423** (0.139)	0.361 (0.293)
Trend	0.036 (0.034)	0.004 (0.017)	0.032 (0.024)	0.042 (0.053)	-0.014 (0.033)	0.057 (0.042)
Year Dummies	X	X	X	X	X	X
Country Dummies	X	X	X	X	X	X
Country Dummies*Trend	X	X	X	X	X	X
Country Dummies*Sept 11 Effect	X	X	X	X	X	X
N	324	324	324	862	862	862
R-squared	0.9946	0.9971	0.9828	0.9882	0.9941	0.9628

Note: Robust standard errors are in parentheses. ** denotes significance at 1 percent level; * denotes significance at 5 percent level. Sources: SIAT, 1993-2003; U.S. Census Bureau, 1993-2003; World Bank, World Development Indicators, 1993-2003; Malloy (2001); U.S. Department of the Treasury, Office of Foreign Assets Control; Crystal (2003).

export volumes per variety, as an important piece of evidence in the case for business networks in international trade.

2.5 Business Networks & the Transfer of Information

In the previous section, I presented evidence consistent with the importance of business and social networks in international trade, exploiting the events surrounding September 11 to control for an additional potential source of variation in international travel and international trade. In this section, I further explore the idea that business travel acts as a conduit for face-to-face communication to seal international export transactions. Business travel for the purpose of face-to-face meetings is even more important for travelers to non-English speaking countries where communication by telephone or

internet may be less effective. Similarly, the complex nature of differentiated goods requires a larger role for face-to-face meetings to transfer information, whereas such meetings are less important for homogenous products for which prices can convey the relevant information about the profitability of the trade. Finally, we may expect that higher-skilled business travelers may be more effective at creating new export opportunities abroad, as international dealings require a certain skill-level and higher-skilled travelers may be better able to transfer information about profitable opportunities.

Table 2.2 reports results from the estimation of country-level gravity regressions with country and time fixed effects as specified in equation (2.6) by the main language of the trading partner country (traveler's main country of destination). Countries are designated English-speaking or non-English speaking by the official language spoken in the country as detailed in Crystal (2003).

It is clear that the main effect, consistent with the idea of business travel as an input to international trade, is largely driven by business travel to non-English speaking countries. A 10 percent increase in last year's business travel to and from non-English speaking countries increases export varieties from the United States by 0.24 percent. This is larger than the 0.23 percent increase for all countries, suggesting the business travel with non-English speaking countries drives the initial result. Furthermore, the estimated coefficient for lagged business travel to English-speaking countries is statistically insignificant.

Table 2.3 reports results from the estimation of country-level gravity regressions with country and time fixed effects as specified in equation (2.6) for all countries, by product differentiation. Commodities are classified according to the Rauch (1999) classification of goods. I define both goods traded on an organized exchanged and goods with a reference price to be homogeneous goods.

While the coefficient of interest on lagged business travel is larger for differentiated products than for homogeneous goods, the results suggest that business travel is an input to international trade for all product-types. The hypothesis that the more information-intensive nature of differentiated products over homogeneous goods requires more business travel to facilitate international export opportunities does not hold in the data. An equal increase in business travel generates only a 0.02 percent larger increase in the va-

Table 2.3: Business Travel and International Trade, by Product Differentiation

Dep. Variable:	Homogeneous Goods			Differentiated Products		
	EX_{USjt}	EV_{USjt}	$\frac{EX}{EV}_{USjt}$	EX_{USjt}	EV_{USjt}	$\frac{EX}{EV}_{USjt}$
BUS_{USjt-1}	0.026 (0.022)	0.024* (0.012)	0.002 (0.022)	0.042* (0.017)	0.026** (0.008)	0.016 (0.015)
LEI_{USjt-1}	0.008 (0.022)	-0.003 (0.013)	0.011 (0.023)	-0.028 (0.017)	-0.0005 (0.008)	-0.027 (0.015)
POP_{jt}	0.433 (1.155)	0.824 (0.667)	-0.391 (1.388)	1.862 (1.212)	0.620 (0.793)	1.243 (1.239)
$PCGDP_{jt}$	0.493** (0.132)	0.217** (0.065)	0.276* (0.127)	0.525** (0.107)	0.305** (0.050)	0.220* (0.090)
SAN_{USjt}	0.319 (0.255)	-0.139* (0.067)	0.458 (0.260)	0.118 (0.143)	-0.189* (0.086)	0.307** (0.108)
Trend	0.007 (0.045)	-0.035 (0.026)	0.043 (0.046)	-0.005 (0.042)	-0.009 (0.027)	0.003 (0.038)
Year Dummies	X	X	X	X	X	X
Country Dummies	X	X	X	X	X	X
Country Dummies*Trend	X	X	X	X	X	X
Country Dummies*Sept 11 Effect	X	X	X	X	X	X
N	1182	1182	1182	1186	1186	1186
R-squared	0.9879	0.9946	0.9488	0.9923	0.9944	0.9794

Note: Robust standard errors are in parentheses. ** denotes significance at 1 percent level; * denotes significance at 5 percent level. Sources: SIAT, 1993-2003; U.S. Census Bureau, 1993-2003; World Bank, World Development Indicators, 1993-2003; Malloy (2001); U.S. Department of the Treasury, Office of Foreign Assets Control; Rauch (1999).

riety of differentiated product exports over the increase in the variety of homogeneous product exports.

Table 2.4 reports results from the estimation of country-level gravity regressions with country and time fixed effects as specified in equation (2.6) for all countries, by the skill-level of the traveler. This chapter will distinguish between professional & managerial workers, as defined by managers, executives, professional or technical workers, and clerical & production workers, as defined by clerical workers, salespeople, craftspeople, factory workers, and mechanics.²³

The evidence is consistent with the hypothesis that higher-skilled travelers, as defined by professional & managerial workers over clerical & production workers, are better able to transfer information about profitable trading opportunities. The effect of

²³The SIAT also classifies occupations into government/military, homemaker, students, and those travelers who are retired.

Table 2.4: Business Travel and International Trade, by Traveler Skill-Level

Dep. Variable:	Clerical & Production			Professional & Managerial		
	EX_{USjt}	EV_{USjt}	$\frac{EX}{EV}_{USjt}$	EX_{USjt}	EV_{USjt}	$\frac{EX}{EV}_{USjt}$
BUS_{USjt-1}	0.007 (0.008)	0.003 (0.002)	0.003 (0.007)	0.034* (0.017)	0.021** (0.007)	0.013 (0.015)
LEI_{USjt-1}	0.013 (0.011)	0.004 (0.003)	0.009 (0.010)	-0.018 (0.017)	-0.0004 (0.009)	-0.018 (0.015)
POP_{jt}	0.536 (0.457)	0.189 (0.245)	0.373 (0.252)	0.632 (1.009)	0.362 (0.834)	0.271 (0.938)
$PCGDP_{jt}$	0.554** (0.077)	0.251** (0.033)	0.303** (0.055)	0.446** (0.110)	0.294** (0.050)	0.152 (0.089)
SAN_{USjt}	-0.014 (0.088)	-0.016 (0.029)	0.022 (0.069)	0.155 (0.215)	-0.181 (0.108)	0.336 (0.190)
Trend	0.069** (0.018)	0.035** (0.009)	0.034 (0.017)	0.037 (0.039)	-0.004 (0.028)	0.041 (0.031)
Year Dummies	X	X	X	X	X	X
Country Dummies	X	X	X	X	X	X
Country Dummies*Trend	X	X	X	X	X	X
Country Dummies*Sept 11 Effect	X	X	X	X	X	X
N	604	604	604	1162	1162	1162
R-squared	0.9976	0.9988	0.9950	0.9901	0.9948	0.9709

Note: Robust standard errors are in parentheses. ** denotes significance at 1 percent level; * denotes significance at 5 percent level. Sources: SIAT, 1993-2003; U.S. Census Bureau, 1993-2003; World Bank, World Development Indicators, 1993-2003; Malloy (2001); U.S. Department of the Treasury, Office of Foreign Assets Control.

lagged business travel on export varieties for the set of professional and managerial travelers is positive and statistically significant. A ten percent increase in business travel by professional and managerial workers from the U.S. to country j last year increases export varieties from the U.S. to country j by 0.21 percent. Furthermore, the coefficient of interest on lagged business travel for the set of clerical and production travelers is statistically indistinguishable from zero.

To reinforce tables 2.2 to 2.4, table 2.5 reports results from the estimation of equation (2.6) for professional and managerial workers traveling to non-English speaking countries, by product differentiation. Again, the results are stronger for higher-skilled workers, traveling to non-English speaking countries, and trading differentiated products. This evidence supports the idea of business travel to facilitate face-to-face meetings as an input to international trade. The theory behind business and social networks in international trade is confirmed.

Table 2.5: Business Travel and International Trade, by Product Differentiation: Non-English Speaking Countries and Professional & Managerial Workers

Dep. Variable:	Homogeneous Goods			Differentiated Products		
	EX_{USjt}	EV_{USjt}	$\frac{EX}{EV}_{USjt}$	EX_{USjt}	EV_{USjt}	$\frac{EX}{EV}_{USjt}$
BUS_{USjt-1}	0.057* (0.023)	0.014 (0.014)	0.043 (0.025)	0.042 (0.023)	0.021* (0.009)	0.020 (0.019)
LEI_{USjt-1}	0.022 (0.026)	-0.007 (0.016)	0.029 (0.027)	-0.025 (0.020)	-0.004 (0.010)	-0.022 (0.017)
POP_{jt}	-1.560 (1.982)	0.691 (1.185)	-2.251 (2.376)	1.188 (2.092)	0.679 (1.444)	1.209 (2.265)
$PCGDP_{jt}$	0.558** (0.152)	0.245** (0.082)	0.313* (0.155)	0.609** (0.132)	0.317** (0.056)	0.292** (0.109)
SAN_{USjt}	0.455 (0.385)	-0.307 (0.174)	0.762* (0.359)	0.017 (0.266)	-0.435* (0.203)	0.451 (0.234)
Trend	0.037 (0.048)	-0.012 (0.029)	0.049 (0.056)	0.032 (0.052)	-0.014 (0.035)	0.046 (0.055)
Year Dummies	X	X	X	X	X	X
Country Dummies	X	X	X	X	X	X
Country Dummies*Trend	X	X	X	X	X	X
Country Dummies*Sept 11 Effect	X	X	X	X	X	X
N	840	840	840	844	844	844
R-squared	0.9892	0.9954	0.9512	0.9908	0.9939	0.9755

Note: Robust standard errors are in parentheses. ** denotes significance at 1 percent level; * denotes significance at 5 percent level. Sources: SIAT, 1993-2003; U.S. Census Bureau, 1993-2003; World Bank, World Development Indicators, 1993-2003; Malloy (2001); U.S. Department of the Treasury, Office of Foreign Assets Control; Crystal (2003); Rauch (1999).

2.6 Robustness Checks

In this section, I provide a check for the robustness of the estimation results in section 2.4.2, by testing the importance of time in building relationships in international trade.

The basis for the empirical model is that business travel is a fixed cost input to international trade. It is implicit that new export varieties are not contemporaneous but require time, perhaps “many trips” as Frankel (1997) suggests, to begin international transactions. In table 2.6, I estimate equation (2.6) with an additional lag each of business and leisure travel. The results confirm the hypothesis that business travel acts as an input to international trade, but it appears that business travel no more than one year prior has a positive and significant effect on new export varieties.

Table 2.6: Robustness Check: Two Lags

Dep. Variable:	EX_{USjt}	EV_{USjt}	$\frac{EX}{EV}_{USjt}$
BUS_{USjt-1}	0.034 (0.019)	0.022* (0.008)	0.012 (0.016)
BUS_{USjt-2}	0.009 (0.015)	-0.001 (0.007)	0.010 (0.014)
LEI_{USjt-1}	-0.003 (0.018)	0.009 (0.008)	-0.012 (0.016)
LEI_{USjt-2}	-0.011 (0.016)	0.013 (0.007)	-0.001 (0.015)
POP_{jt}	0.558 (0.960)	0.709 (0.796)	-0.051 (1.064)
$PCGDP_{jt}$	0.512** (0.123)	0.294** (0.050)	0.248* (0.099)
SAN_{USjt}	0.358 (0.277)	-0.070 (0.105)	0.427 (0.261)
Trend	0.041 (0.033)	-0.006 (0.025)	0.047 (0.035)
Year Dummies	X	X	X
Country Dummies	X	X	X
Country Dummies*Trend	X	X	X
Country Dummies*Sept 11 Effect	X	X	X
N	954	954	954
R-squared	0.9915	0.9959	0.9759

Note: Robust standard errors are in parentheses. ** denotes significance at 1 percent level; * denotes significance at 5 percent level. Sources: SIAT, 1993-2003; U.S. Census Bureau, 1993-2003; World Bank, World Development Indicators, 1993-2003; Malloy (2001); U.S. Department of the Treasury, Office of Foreign Assets Control.

2.7 Conclusion

The qualitative nature and quantitative importance of informal barriers to international trade remains an important question in international economics. Travel helps to overcome these barriers both by building and maintaining transnational information-sharing networks and through direct sales and service effort. This study examines the causal relationship between travel and trade, the relative effectiveness of different kinds of travel and different characteristics of travelers in promoting trade, and the relative importance of travel for trade in different types of goods. All of these results will help policymakers and academics alike to gain a better understanding of how informal barriers to trade work and how large they are.

The main results are consistent with the view that business travel for the purpose of

communication acts as a fixed cost to enter into foreign export markets. The effect is driven by travel to non-English speaking countries, for which communication with the U.S. by other means may be less effective. Moreover, the effect is stronger for higher-skilled travelers, reflecting an enhanced ability to transfer information about trading opportunities.

My results have direct implications for policy. By quantifying the extent to which international business travel causes international trade, this study can help to evaluate the many government programs worldwide that promote business travel for the purpose of creating trade.

3

Predictions for Internal Formal-Sector Migration in Brazil

3.1 Introduction

When economies adjust to globalization, local resources shift. Workers change jobs and internal migration flows ensue, depending on the degree of individual mobility. We study the association between international economic integration and domestic migration using novel data that comprehensively track individual workers and their employers over time in Brazil, a leading developing country. Brazil underwent salient efforts to integrate its economy globally, and simultaneously experienced an acceleration in domestic migration.

Brazil has a long history of high rates of internal migration, similar to many developing countries. Over the past century, massive flows of internal migrants left states in the North and Northeast for the growing urban centers in the Southeast and for Brasília (Library of Congress (1998)). Migration has not subsided. To the contrary, estimates of lifetime interstate migration rates grew from 20 percent of the population in 1980 (Martine (1990)) to 40 percent of the population in 1999 (Fiess and Verner (2002)). This migration surge coincides with market-oriented reforms and Brazil's progressing integration into the global economy since the late 1980s. Brazil implemented major trade reforms in the early 1990s, trade integration with its Southern Cone neighbors in

1993, gradual foreign-direct investment liberalizations over the 1990s, and an exchange-rate devaluation in 1999 that facilitated foreign market access for exporters. The total stock of foreign direct investment (FDI) in Brazil, for instance, stood at US\$ 115.5 billion in 1995. Within five years, this stock more than quintupled following Brazil's trade and capital-account liberalizations and macroeconomic stabilization (Rodrigues (2000)). Most foreign investments flowed to newly privatized utilities and services companies so that industries beyond manufacturing were impacted.

We document recent migration patterns across states in Brazil using novel and, in their scope, internationally unprecedented linked employer-employee data for a developing country. The data show that one third of the job-changing workers in Brazil's formal sector migrate across state borders to find new formal employment every year in the 1990s. Contrary to long term evidence from household cross-sections, we show that recent annual migration flows of formal-sector workers are directed towards uncommon destinations. Select states in the Center-West, North and Northeast receive large flows of formal-sector immigrants. This stands in contrast to the assertion that the typical migrant flow in Brazil runs from North to South.

Our data link workers to their employers and are uniquely suited to investigate to what extent factors related to globalization are associated with observed migration flows. There is a robust association between globalization-related employer characteristics and formal-sector migration across states. While the majority of workers move between domestic and non-exporting establishments, there are notable differences between migrants and stayers in their exposure to foreign-owned and exporting establishments. The average migrant in the sample is more likely to move to a job at a foreign-owned or exporting establishment than a non-migrant. Job changers to foreign-owned establishments benefit from a considerably steeper tenure-wage profile than workers at domestic-owned establishments.

We further investigate these mean sample characteristics in a multivariate analysis that incorporates the methodology proposed by Dahl (2002) to account for the many destination choices that a migrant faces. The descriptive results provide additional support for the idea that globalization acts on internal migration through the growth of employment opportunities at locations with a high concentration of foreign-owned

establishments and the stability of employment at exporting establishments. The importance of the presence of foreign-owned establishments in the immigration region, beyond the spot wage, is consistent with the economic rationale that migrants can expect benefits beyond the spot wage difference, such as steeper wage paths at foreign-owned establishments or more favorable overall labor-market conditions.

The remainder of this chapter is organized as follows. In the next section, we summarize the literature on internal migration and discuss recent market-oriented policy reforms in Brazil. Section 3.3 describes the data and offers descriptive statistics relating globalization and cross-state migration in Brazil. Section 3.4 offers multivariate support for the descriptive evidence. We introduce the statistical model of the migration decision, paying special attention to self-selection of migrants, and present estimation results alongside. We conclude with final remarks.

3.2 Internal Migration and Policy Reforms

Considerable economic disparities persist between Brazil's five regions. As table 3.1 shows, per capita GDP in the Southern regions (South and Southeast) is more than triple the per capita GDP level in the Northern regions (North and Northeast).¹ Even within regions, incomes between Brazil's 27 states differ. These regional disparities offer incentives for migration. Brazil's population in 2001 was approximately 176 million, with around half (85 million) actively participating in the labor force (World Bank (2005)). The International Labor Organization estimates that 66 percent of the labor force held a formal-sector job in 1997 (Meier and Rauch (2005)). Our data cover the formal sector.

3.2.1 Internal migration

Historically, migrants in Brazil moved to cities where import-substituting industries flourished and away from the rural interior that underwent agricultural modernization

¹The high average GDP per capita in the Center-West region is misleading, as the capital city in the Distrito Federal (DF) largely drives the results (the median per capita GDP for the region is only \$5,925). Per capita GDP in the Distrito Federal is the highest in the country (\$13,604), compared to only \$4,403 in the neighboring state of Goias (GO).

Table 3.1: Average Regional Characteristics, 1997-2001

	GDP per capita	Population (millions)	Share of Value Added in			Urbani- zation
			Agriculture	Manufact.	Services	
North	2,667	1.9	0.106	0.260	0.634	0.004
Northeast	2,111	5.4	0.094	0.345	0.561	0.031
Southeast	7,507	18.3	0.054	0.416	0.529	0.094
South	6,762	8.5	0.139	0.428	0.433	0.130
Center-West	7,464	3.0	0.188	0.206	0.606	0.009
Average	4,364	6.4	0.110	0.322	0.568	0.041

Source: IBGE, 1997-2001.

(Martine (1990)). Declining agricultural prices contributed to rural displacement, and migration to the coastal cities accompanied Brazil's industrialization process and urban growth (e.g., Yap (1976) and Graham (1970)). The combination of rising wages in the industrial South and declining wages in the rural North accelerated the flight from rural areas over the decades. Using data from the Brazilian decennial censuses, Martine (1990) reports that the number of Brazilians residing in a state other than the state of birth was 3.5 million in 1940 (or 9 percent of the population). This share increases steadily until 1980, when close to 20 percent of the population reside outside their state of birth.² Migration accelerates further during the last two decades of the 20th century and results in a doubling of the migrant population share (with the primary residence outside the birth state) to 40 percent by 1999 (Fiess and Verner (2002)).

Research into determinants of internal migration can be classified into two broad categories: research that concentrates on migrant characteristics, and research that concentrates on regional characteristics and differentials as primary determinants. Early studies on Brazil, such as Sahota (1968), Graham (1970) and Yap (1976), related internal migration to regional and sectoral wage and income differences. In a recent study, Fiess and Verner (2002) place primary attention on migrant and stayer characteristics. Fiess and Verner find that migrants from the Northeast to the Southeast face strong economic incentives for migration, while migrants from the Southeast region to the Northeast region confront lower estimated returns to migration, suggesting other

²Graham (1970), Martine (1990) and Schmertmann (1992) provide a detailed history of the Brazilian migration experience.

non-pecuniary factors may play a relatively larger role.

Lacking information on employer-level, or municipality-level, exposure to international markets, prior research largely neglects the role of market-oriented reforms and globalization for internal migration flows. The main purpose of this chapter is to uncover the relationship between formal-sector migration and economic reform, as promoted through Brazil's trade, investment and macro policy shifts. We control for wage differentials and self-selection of migrants, using a one-percent random sample of the national workforce, and identify the workers' annual state-to-state migrations between 1997 and 2001. While much of the previous work identifies single migration decisions from a cross section of workers, drawing on decennial censuses or household surveys, the depth of our novel matched employer-employee data set allows us to identify worker mobility at the annual horizon and to incorporate employer-level information on exposure to global markets. Contrary to worker cross sections, where worker characteristics are typically only measured at a single time after migration, we can draw on worker, employer, and location information before and after migration. Lacking information on informal workers, however, our results can only represent migration flows within the formal sector.

Prior research shows that chief among the migration determinants are migrant characteristics such as age, sex, educational attainment, as well as regional characteristics such as per capita income differentials and urbanization rates. Beyond those covariates, we include factors related to globalization at the migrant level—employment in a multinational enterprise and employment in an exporting establishment—, and control for state-level information on the share of foreign-owned and exporting establishments as factors in the migration decision. Our data do not include family variables like marital status or the number of children, however, which prior research has shown to be associated with migration. Inasmuch as family variables are related to prior workforce experience, which we observe at the individual level, we can control for their impact on migration selection.

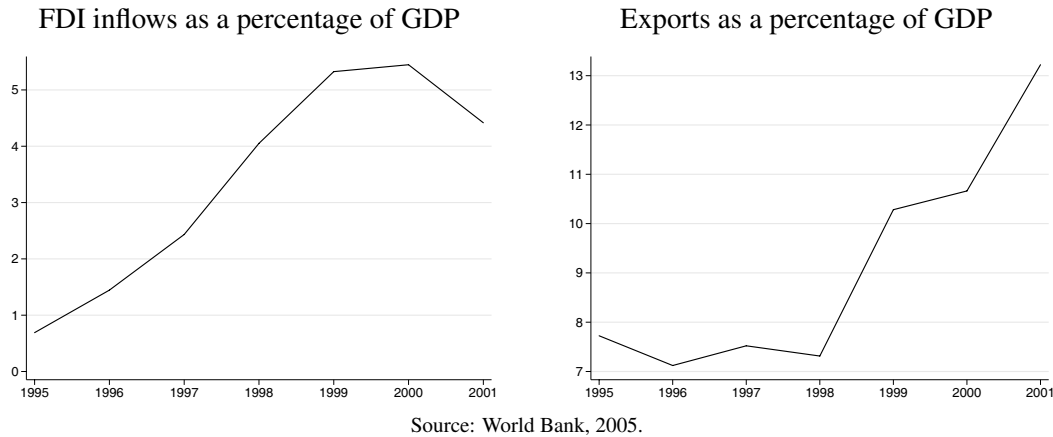


Figure 3.1: Foreign Direct Investment Inflows and Exports, 1990-2001

3.2.2 Brazil's policy reforms

Brazil offers a particularly appropriate setting to study the association between globalization and internal formal-sector migration because salient liberalizing policy reforms occurred over a short period of time. The marked time variation, and differential regional responses to Brazil's large-scale national reforms, allow us to discern the effects of globalization on internal migration from other simultaneous but more gradual economic changes. Figure 3.1 illustrates the considerable increases in foreign direct investment inflows and exports as a percentage of GDP for the Brazilian economy between 1995 and 2001 (World Bank (2005)). These notable changes followed trade liberalization and macroeconomic stabilization policies, which helped bring down inflation levels and opened the Brazilian market to international competition.

Average tariff rates fell from 41 percent to 18 percent between 1988 and 1989. In the early 1990s, Brazil abolished the remaining non-tariff barriers inherited from the import substitution industrialization era (Averbug (2000)), brought nominal tariffs further down to below 15 percent, and formed the free trade area Mercosul with its Southern Cone neighbors Argentina, Paraguay and Uruguay. Brazil's entry into Mercosul in 1991 was instrumental in attracting inflows of foreign direct investments to the country as a regional export base for multinational firms (Pineiro and Moreira (2000)). After decades of inflation and several unsuccessful stabilization attempts, the Brazilian government succeeded with its fierce macroeconomic stabilization plan *Plano Real* in 1994 and last-

ingly ended hyperinflation. These reforms put Brazil's economy on a pro-competitive basis and precede our sample period 1996-2001. It is mainly during the second half of the 1990s that the Brazilian economy exhibits heightened capital inflows and exporting activity (figure 3.1). We hypothesize that Brazil's progressing integration into the global economy is related to domestic factor reallocations, which in turn should be associated with formal-sector migration flows.

3.3 Data Sources and Descriptive Statistics

Our main data source are Brazil's administrative records of formal-sector workers and their employers. We combine this worker information with complementary data sources on foreign and exporting establishments, industries, and state-level characteristics.

3.3.1 Worker data

The linked employer-employee data come from the Brazilian Labor Ministry (*Ministério do Trabalho e Emprego*). By law, all registered establishments are required to report to the ministry on their workers every year. In practice, only formally-employed workers will be properly reported. This information is collected in the data base *Relação Anual de Informações Sociais* (RAIS) since 1986. For most of our analysis, we use information from RAIS for the years 1997 through 2001 when we also have complementary information. RAIS includes the worker ID (*Programa de Integração* (PIS)), similar to a social security number in the United States. Also included in the data are the tax number of the worker's establishment (*Cadastro Nacional de Pessoa Jurídica* (CNPJ)), the industrial classification of the worker's establishment (*Classificação Nacional de Atividades Econômicas* (CNAE)) and the municipality of the worker's establishment.³

The main benefit of the RAIS database is the ability to track individually identifiable workers over time, across establishments, and across municipalities and states. Brazil-

³A worker's ID generally remains with the worker throughout his or her work history. The process for establishments to report on their workers is extensive and costly. However, RAIS records are used to administer payment of the annual public wage supplements to every formally-employed worker, thus creating a strong incentive for workers to urge their employers to report accurately.

ian establishment tax numbers are common across many databases so that RAIS information can be combined with complementary establishment-level data sources. The RAIS worker data offer information on annual real wages, tenure at the establishment, gender, age, and educational attainment.⁴ RAIS covers establishments in any sector, so workers in the services and utilities industries, to which much of the foreign investments were directed in the second half of the 1990s, are included.

We draw a one-percent random sample of the national data and restrict observations as follows. First, only workers with correct eleven-digit worker IDs are included.⁵ Following Abowd et al. (1999), we restrict the set of workers to only those workers receiving positive wages. Finally, for workers with multiple jobs in a given year, only the most recent job is included in the sample. If a worker has multiple current jobs, the highest paying job is included in the sample. This restriction rests on the assumption that workers most likely rely on the last and highest-paying job of the year in their decision to migrate.

3.3.2 Complementary establishment and state data

By law, all foreign investments are registered with Brazil's central bank (*Banco Central do Brasil*, BCB) in its *Registro Declaratório Eletrônico—Investimentos Externos Diretos* (RDE-IED). The RDE-IED is available from the BCB for the years 1997 through 2001. We define an establishment to be (partly) foreign-owned in year t if the establishment received an inflow of foreign capital in year t . We note that establishments receiving inflows of foreign capital in year t may maintain foreign relationships in later years. Therefore, establishments are counted as foreign-owned in all years $\tau \geq t$ after the initially observed inflow at year t .⁶ Finally, we consider foreign funds at the holding-company level to affect all establishments of the corporate group. Using BCB

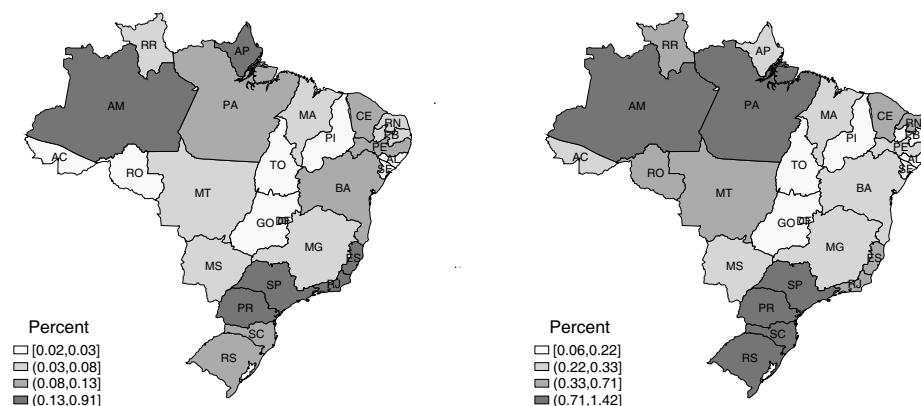
⁴Educational attainment is defined as the level of schooling completed.

⁵Eleven digits is the traditional length of a PIS number in Brazil. Shorter PIS numbers are defective and not trackable over time. Firms that enter false identification numbers could be reporting informal workers, or have faulty bookkeeping.

⁶We may miss (partly) foreign-owned establishments if there was an initial inflow of foreign capital before our sample period, and no inflow during our sample period. Note, however, that retained earnings are inflows under common foreign-direct investment definitions so that inflows are likely to be observed in every year of foreign ownership. Missing some (partly) foreign-owned establishments moves the odds of detecting a statistically significant effect of foreign ownership against us.

Shares of Foreign-Owned Establishments

Shares of Exporting Establishments



Sources: RDE-IED and SECEX, 1997-2001.

Figure 3.2: Global Integration of Brazilian States, 1997-2001

information on the corporate ownership relations among Brazilian firms, we therefore also count an establishment as foreign-owned in year $\tau \geq t$ if it is a subsidiary of a company receiving inflows of foreign capital in year t . Matching the RDE-IED information to RAIS at the establishment level, we define an indicator variable equal to one iff a worker holds a job at a foreign-owned establishment. We also compute the share of foreign-owned establishments at the state level.

We use exporter status data from the Brazilian customs office (*Secretaria de Comércio Exterior*, SECEX). SECEX maintains an establishment-level data set consisting of all legally-registered exporting establishments in Brazil with at least one export transaction in a given year. We match SECEX information from 1997 through 2001 to RAIS and define an indicator variable equal to one iff a worker holds a job at an establishment with a positive dollar value of free-on-board exports in a given year. We also compute the share of exporting establishments at the state level.

Figure 3.2 shows average shares of foreign-owned establishments and of exporting establishments by state between 1997 and 2001, with darker shades reflecting higher shares. Amazonas (AM), in the North, has the highest share of foreign investments, as defined by the share of foreign-owned establishments in the state during the five year period from 1997 to 2001. This is likely a consequence of Brazil's exports promotion programs and export processing zones in the Amazon. São Paulo (SP) and Rio

de Janeiro (RJ) states rank second and third, respectively. The Northeastern states of Tocantins (TO), Sergipe (SE), and Acre (AC) are the locations with the smallest shares of foreign ownership. The Amazon also ranks the highest in terms of exporting establishments to total establishments. The state of Pará (PA), also in the North, has the second highest share of exporting establishments. Otherwise, exporting establishments are largely concentrated in the Southern regions.

We obtain state-level information on population, GDP per capita, urbanization rates, and value added in agriculture, manufacturing, and services from the Brazilian census bureau (*Instituto Brasileiro de Geografia e Estatística* (IBGE); see table 3.1 in section 3.2). These variables are traditionally reported among the key determinants of the migration decision.

3.3.3 Complementary trade data

To reflect a Brazilian industry's lagged exposure to global competition, we obtain export and import information from WTF (*World Trade Flow*) data for the years 1996-2000 (Feenstra, Lipsey, Deng, Ma and Mo (2005)); we extract sector-level trade flow statistics by *SITC Rev. 2* 4-digit product category in current US\$ for Brazil's exports and imports, and map the trade-flow information to the 2-digit *CNAE* sector level in RAIS (broadly comparable to the *SITC* 2-digit level). We then use a state's industry composition from RAIS to calculate last period's location-specific exposure to foreign trade.

3.3.4 Migrant and stayer characteristics

The complete linked employer-employee database includes the full employment history of formal-sector workers in Brazil from 1997 through 2001. We define workers as *migrants* if the state of the worker's establishment at time t is different from the state of the worker's establishment at time $t + 1$. Conversely, if a worker remains in the same state for years t and $t + 1$, he is considered a *stayer* but may switch employers within the same state.

The final one-percent random sample includes 1,548,131 workers in 339,515 estab-

ishments over the period 1997 through 2001. We use the 1,005,010 individuals who appear in the data for at least two consecutive time periods to calculate annual migration statistics. The workers are from any of the 27 states and any sector of the economy. Migrants represent around 2 percent of the complete sample (22,837 individuals) in the annual average. Formal-sector migrants are most often from the Center-West and Northern regions, where 3.9 percent and 3.0 percent of workers are migrants, respectively, while workers in the Southeastern region are least likely to move between states (2.0 percent of workers migrate). As a consequence of annual migration rates around two percent on average, small differences in employment patterns may have a potentially strong impact on migration patterns.

Small annual migration rates can nevertheless be associated with considerable migration backgrounds in a cross section of households and workers. Suppose a worker's migration odds are independent of past migration and that a worker migrates only after he has earned 40 years labor force experience. Then an annual migration rate of 2 percent among formal-sector workers will result in a share of 55 percent of workers with a migration background among the cohort just before retirement ($1 - .98^{40}$), and a 33 percent migration background for a worker half-way through the active time in the labor force ($1 - .98^{20}$). Little is known about the odds of repeat migration, and little is known about annual migration rates among workers outside the formal sector. Yet the notable share of Brazil's population with a cross-state migration background—around 40 percent by the late 1990s (Fiess and Verner (2002))—, suggests that the annual formal-sector migration rate of around 2 percent is perhaps similar to overall migration rates.

Table 3.2 contrasts average worker characteristics of migrants and stayers between 1997 and 2001. Though migrants and stayers in our formal-sector sample are remarkably similar, there are a few key differences. Formal-sector migrants are less likely to have a high school degree and more likely to have only a primary school education than stayers. Meanwhile, migrants are equally likely to have at least some college education as non-migrants. This highlights an important difference between our data on formal-sector migration and conventional statistics on rural-to-urban migration in developing countries. Formal-sector migration is relatively higher-skilled migration. Over 6 percent of formal-sector workers with at least some college migrate across state lines at

Table 3.2: Average Worker Characteristics, 1997-2001

	Full Sample	Migrants	Stayers
<i>Worker Characteristics</i>			
Primary School	0.563	0.587	0.563
High School	0.303	0.280	0.304
Some College	0.033	0.039	0.033
College Graduate	0.101	0.094	0.101
Female	0.372	0.210	0.376
<i>Time-Variant Characteristics</i>			
Age in year t	34.0	31.5	34.1
Log Average Wages in t	8.08	8.18	8.08
Log Average Wages in $t + 1$	8.14	8.19	8.13
Employed in Foreign Establishment in year t	0.022	0.039	0.022
Employed in Foreign Establishment in year $t + 1$	0.028	0.052	0.027
Employed in Exporting Establishment in year t	0.085	0.081	0.085
Employed in Exporting Establishment in year $t + 1$	0.086	0.080	0.086
Number of Observations	1,005,010	22,837	982,173

Note: Worker characteristics in the upper panel are largely time invariant except for infrequent advances in educational attainment after entry into the formal-sector labor force.

Sources: RAIS (1-percent random sample), RDE-IED, and SECEX, 1997-2001.

least once during the sample period. In contrast, just 2.4 percent of formal-sector workers with a high school degree migrated during the five year period and 2.8 percent of workers with only a primary school education are migrants.

This pattern exhibits only some regional variation across emigrant region. In any region except for the South, workers with at least some college are more likely than workers with lower levels of education to migrate; only in the South are workers with at least some college and workers with a primary or high school education equally likely to migrate. Formal-sector migrants of all education levels are most likely to migrate from the Center-West region, consistent with the high total emigration from this state. At the state level within regions, there is some variability. Workers with only a primary school education, for instance, are more likely than the highest skilled workers to migrate out of the Northern states of Roraima and Tocantins, the Northeastern states of Alagoas (AL), Bahia (BA), Sergipe, and Maranhão (MA), and Rio Grande do Norte (RN), and the Center-West state, Mato Grosso (MT). Workers of all levels of education are equally likely to leave São Paulo state.

Migrant demographics vary across immigrant states. While migrating workers who arrive in the Southeast and the Distrito Federal are more likely to be high-skilled, formal-sector workers migrating to the North are more likely to have only a primary school education. The main exception is the state of the Amazon. Our data indicate that the share of high-skilled formal-sector migrants to the Amazon is greater than the share of low-skilled formal-sector migrants. These high-skilled migrants most frequently travel from within the Northern region.

Women are less likely to be formal-sector migrants. This observation is consistent across all states and regions. The rates of migration for men and women are most similar in the Southern region. The average migrant is approximately two years younger than the average stayer. Youth aged 15-17 are least likely to migrate, while young workers (18-24 years) are most likely to migrate.

Wages for formal-sector migrants, both before and after the migration decision, are higher than wages for stayers. Before the migration decision, the average migrant earns average annual wages approximately 10 percent higher than stayers. The wage differential falls to 6 percent after the migration decision. Migration theory based on neoclassical human capital theory posits that workers search for jobs that offer the highest economic return in expected future wages. If the expected wage differential is a main determinant of the migration decision, the drop in the wage differential suggests that expectedly steeper or more certain future wage paths could be important factors for the migration decision beyond the spot wage differential.

3.3.5 Job changes and migration

Nationwide, between forty percent and half of all formal-sector workers change jobs per year, as table 3.3 shows. In metropolitan areas, however, turnover is considerably smaller than the nationwide average, with only around one in four metropolitan workers changing jobs. Transfers of workers within firms but across states are only a minor component of formal-sector migration. Migration is a remarkably important choice for workers with formal-sector job changes (who neither retire nor exit the formal sector). Nationwide, roughly two thirds of the job-changing workers switch employment within state (the proportion of the same-state job changers in all job changers), but one third

Table 3.3: Job Retentions and Changes, 1997-2001

	1997	1998	National 1999	2000	2001
Job retention					
Same Location	0.606	0.570	0.526	0.502	0.484
Transfer	0.004	0.004	0.003	0.003	0.003
Job changes (frequencies conditional on no retention)					
Same State	0.255	0.203	0.176	0.154	0.148
Migrate Metro	0.051	0.052	0.042	0.044	0.055
Migrate Other	0.075	0.073	0.063	0.060	0.087
Other changes (frequencies conditional on no retention)					
Retire	0.040	0.051	0.060	0.066	0.071
Formal Exit	0.569	0.611	0.653	0.669	0.633
	1997	1998	Metropolitan Areas 1999	2000	2001
Job retention					
Same Location	0.728	0.741	0.730	0.759	0.756
Transfer	0.004	0.005	0.005	0.004	0.005
Job changes (frequencies conditional on no retention)					
Same State	0.468	0.474	0.428	0.487	0.514
Migrate Metro	0.014	0.017	0.014	0.019	0.019
Migrate Other	0.020	0.019	0.023	0.020	0.025
Other changes (frequencies conditional on no retention)					
Retire	0.035	0.037	0.038	0.034	0.041
Formal Exit	0.447	0.432	0.480	0.423	0.381

Note: End-years of annual worker continuations and transitions between jobs. Transfers are changes of establishment across state borders but within firms. Retirements include reported deaths on the job. Formal-sector exits are to informal employment, unemployment, self employment, or out of the labor force.

Sources: RAIS (1-percent random sample), RDE-IED, and SECEX, 1996-2001.

migrate across state borders.⁷ There is a slightly less than one-half chance that cross-border job changers move to a metropolitan area. Two to three in five workers with a job loss exit the formal sector at the annual horizon. Menezes-Filho and Muendler (2007) analyze this type of transition using household data. The focus of the present chapter lies on the migrants with a successful reallocation.

⁷The fact that one third of formal-sector job switchers are cross-state migrants is of particular importance to the conduct of repeated household surveys, which invariably classify these households as missing and thus potentially exaggerate transitions into unemployment.

Table 3.4: Establishment Types and Migration, 1997-2001

	Full Sample		Migrants		Stayers	
	Number	Share	Number	Share	Number	Share
Workers with job change, switching establishment types						
domestic to foreign-owned	5,422	0.026	733	0.035	4,709	0.025
foreign-owned to domestic	3,256	0.016	492	0.024	2,764	0.015
non-exporting to exporting	9,759	0.047	1,027	0.050	8,732	0.047
exporting to non-exporting	11,024	0.053	1,082	0.052	9,942	0.054
Workers with job change, remaining in establishment types						
domestic establishments	196,922	0.954	19,381	0.937	177,541	0.956
foreign-owned establishments	798	0.004	78	0.004	720	0.004
non-exporting establishments	180,360	0.874	18,243	0.882	162,117	0.873
exporting establishments	5,275	0.026	332	0.016	4,943	0.027
Number of Observations	206,418		20,684		185,734	

Sources: RAIS (1-percent random sample), RDE-IED, and SECEX, 1997-2001.

Table 3.4 tracks the 206,418 workers in our sample who changed jobs over a year between types of establishments—domestic or foreign-owned establishments and non-exporting or exporting establishments—, and offers a more manifest indication that globalization may be related to internal migration. The overall odds for a worker at a domestic establishment to change to a multinational enterprise ($0.026/0.954 = 0.027$) are almost ten times smaller than for a multinational worker to change to another foreign-owned establishment ($0.004/0.016 = 0.250$). Similarly, the odds for a worker at a non-exporting establishment to change to an exporter ($0.047/0.874 = 0.054$) are almost ten times smaller than for a worker at an exporter to change to another exporter ($0.026/0.053 = 0.491$).

As a consequence, the bulk of workers move between domestic and non-exporting establishments. But there are notable differences between migrants and stayers in their exposure to foreign-owned and exporting establishments. Since migration frequencies are small at the annual horizon, apparently minor differences can matter for migration outcomes. Of the 206,418 workers with a job change in our sample, 20,684 (10.0 percent) migrate across states. And of these 20,684 migrants, 733 (3.5 percent) switch into a foreign-owned establishment from a domestic establishment with their cross-state

Table 3.5: Average Workforce Characteristics, by Establishment Type, 1997-2001

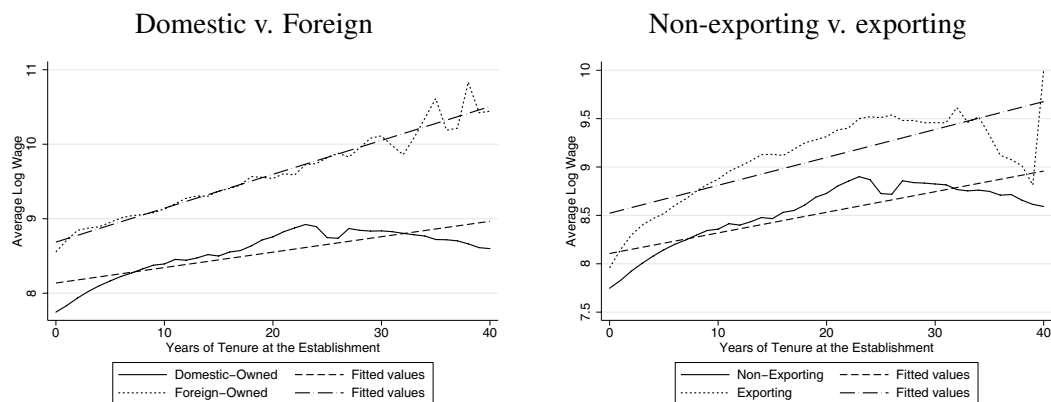
	Full Sample	Foreign	Domestic	Exporting	Non- Exporting
Primary School	0.563	0.362	0.568	0.577	0.562
High School	0.303	0.363	0.302	0.303	0.303
Some College	0.033	0.083	0.032	0.040	0.032
College Graduate	0.101	0.193	0.099	0.081	0.103
Female	0.372	0.259	0.375	0.243	0.384
Age	34.0	33.5	34.0	32.7	34.1
Number of Observations	1,005,010	22,071	982,939	85,677	919,333

Sources: RAIS (1-percent random sample), RDE-IED, and SECEX, 1997-2001.

move; 1,027 (5.0 percent) of the migrants switch into an exporting establishment from a non-exporting establishment after migration. Migrants are more likely to move to a job at a foreign-owned or exporting establishment than the average worker: for non-migrants with a job change, the transition frequencies to a foreign-owned or exporting establishment are only 2.5 percent and 4.7 percent, respectively. Workers with a job change from an exporter to another exporter are more likely to be non-migrants (2.7 percent) than migrants (1.6 percent), however, possibly because exporters are regionally clustered.

Employer characteristics. Table 3.5 shows that workers in foreign-owned establishments are more educated on average than workers in their domestic establishment counterparts. Almost 20 percent of workers at a foreign-owned establishment are college graduates, while only 10 percent of workers at domestic establishments have a college degree. Workers at foreign-owned establishments are on average one-half year younger and less likely to be female than workers at domestic establishments. Workers in exporting establishments are also younger and more likely male than workers in non-exporting establishments. However, workers in exporting establishments are on average less educated. Fifty-eight percent of exporting-establishment workers have only a primary school education.

Wage differentials between current employment and expected future employment are a widely documented determinant of migration. Exporters and foreign-owned establishments typically pay higher wages, partly because of more skilled workforces (see

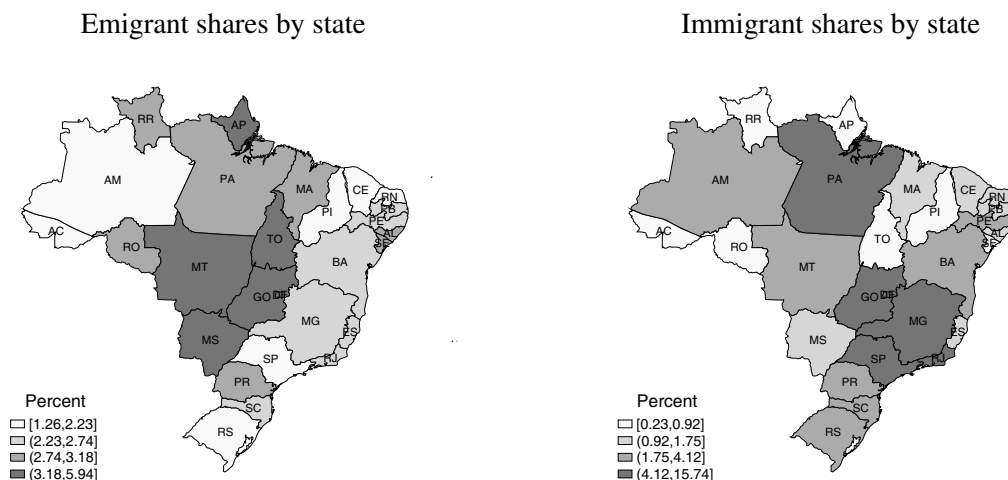


Sources: RAIS (1-percent random sample), RDE-IED, and SECEX, 1997-2001.

Figure 3.3: Tenure-Wage Profiles, by Establishment-Type, 1997-2001

table 3.5) and partly because of firm-fixed effects in compensation (Menezes-Filho, Muendler and Ramey (forthcoming)). Beyond differences in spot wages, expected wage profiles provide incentives for job changes and migration. In figure 3.3, we graph the average log wage for workers over years of tenure at the establishment, by establishment type. The tenure-wage profile for foreign-owned establishments is considerably steeper than the tenure-wage profile for domestic-owned establishments, while there appears to be only a small difference between the tenure-wage paths for exporting and non-exporting establishments. In fact, based on evidence from linear prediction, an additional year of tenure at a non-exporting establishment is associated with 2.1 percent higher wages, while an additional year at an exporting establishment relates to 2.9 percent higher wages. Meanwhile, an additional year of tenure at a multinational enterprise predicts a wage increase by more than double the amount at a domestic-owned establishment (4.5 percent as compared to 2.1 percent).

Emigrant and immigrant states. Figure 3.4 maps the frequency of formal-sector emigration and immigration by state. Formal-sector emigrants are most likely to come from the Northern regions. More than one in twenty workers from Tocantins in the sample migrate to another state between 1997 and 2001. Over 3 percent of workers in Sergipe, Rondônia (RO), Roraima (RR) and Amapá (AP) leave for another state. The share of emigrants in the Center-West region is similarly high. Close to 5 percent of workers from Mato Grosso (MT) and the Distrito Federal are migrants. Emigrants are least likely to come from states in the South and Southeast. Only 1.5 percent and 1.7



Source: RAIS (1-percent random sample), 1997-2001.

Figure 3.4: Emigration and Immigration Frequencies by State, 1997-2001

percent of workers in Rio Grande do Sul and São Paulo, respectively, migrate to another state.

Immigration to the Southeast dominates. Over 15 percent of the sample workforce head to the state of São Paulo, while 6.2 percent and 5.8 percent move to Minas Gerais (MG) and Rio de Janeiro states, respectively. The states of Goiás and the Distrito Federal in the Center-West, Pará in the North and Bahia in the Northeast, however, also receive relatively large flows of immigrants. This stands in contrast to the common assertion that the typical migrant flow in Brazil runs from North to South.

Although a large part of formal-sector migration in Brazil is regional, there is substantial migration from great distances.⁸ Emigrants from Acre in the North are most likely to move across the country to the state of Alagoas in the Northeast and migrants to in Espírito Santo (ES) in the Southeast are most frequently from Alagoas. Not surprisingly, 14 out of 27 states send the highest shares of migrants to São Paulo. Meanwhile, among emigrants from São Paulo state between 1997 and 2001, almost 70 percent moved within the South or Southeast, yet almost 21 percent migrated to states in the Northern regions, and 13 percent migrated to the Center-West region. Immigrants to the Amazon state are most likely to arrive from within the North region, but close to 3 percent of formal-sector migrants moving to the state of Amazonas arrive from the

⁸For a complete state-to-state transition matrix, please contact the authors.

South and Southeast regions.

3.4 Estimation of the Migration Decision

Our objective is to relate formal-sector migration in Brazil to factors associated with Brazil's increasing integration into the global economy. In this section, we accumulate further descriptive evidence, in support of the previous section, using multivariate analysis. The approach allows us to simultaneously condition on multiple covariates associated with formal-sector migration flows, and to discern their importance as predictors for migration. We first treat the self-selection problem inherent in the migration decision, by following a standard econometric approach in the literature and estimate a maximum likelihood model of selectivity-corrected wages developed by Heckman (1979). On the basis of these predicted wages, we follow the methodology proposed by Dahl (2002) and account for the multi-choice decision problem of a migrant.

3.4.1 Self-selection bias

The neoclassical model of migration views expected utility differentials as the underlying forces for migration. Rational individuals optimize expected lifetime utility, given the expected earnings differential and costs to migrate. Non-pecuniary factors such as differences in regional amenities or land values may also enter the utility function and influence the migration decision.

Econometric studies analyzing migration decisions typically depart from a Mincer (1974) wage regression as follows

$$Y_i = \alpha X_i + \beta M_i + \delta Z_s + \epsilon_i, \quad (3.1)$$

where Y_i are log wages for individual i , X_i is a vector of individual characteristics, M_i is a binary variable equal to one if the worker migrates, Z_s is a vector of characteristics for state s , and ϵ_i is the error term.

Estimation of the return to migration based on a comparison of wages (equation (3.1)) between migrants and stayers may be biased due to self-selection. A correctly specified

β could only be recovered directly if we observed a worker once randomly induced to migrate and once to stay. Simplifying equation (3.1), β measures the expected difference in wage outcomes for a worker, conditional on migration, that is:

$$E(\beta|X, Z, M = 1) = E(Y_m|X, Z, M = 1) - E(Y_s|X, Z, M = 1),$$

where $E(\cdot|X, Z, M = 1)$ is the conditional expectation function (conditional on migration and a vector of covariates), and Y_m and Y_s are wage outcomes for a migrant and a stayer. The researcher knows the first element of the term, but it is impossible to observe the second part of the term—wages of a stayer conditional on the counterfactual circumstance that he migrates.

Consider the following decomposition of observed outcome variables—wages of migrants conditional on migration and wages of stayers conditional on staying:

$$E(Y_m|X, Z, M = 1) - E(Y_s|X, Z, M = 1) + E(Y_s|X, Z, M = 1) - E(Y_s|X, Z, M = 0).$$

The first two terms of the expression represent the parameter of interest β , while the last two terms represent the self-selection bias—the difference in counterfactual outcomes depending on whether a worker migrates or stays. Self-selection may occur if migrants are selected by employers in the immigration state on the basis of worker characteristics or if migrants sort themselves into regions and occupations with the highest expected relative earnings.

3.4.2 An econometric model of migration with self-selection

Our estimation procedure derives from the Roy (1951) model of self-selection as extended by Dahl (2002). The approach allows the migration decision and the economic returns from migration to be determined simultaneously.

Consider the migration decision. An individual chooses to migrate depending on the gains and costs of migration. Neglecting other regional attributes for a moment, an individual will migrate if the expected wage differential from migrating exceeds the associated costs:

$$Y_{mi} - Y_{si} > C_i,$$

where Y_{mi} and Y_{si} are wages in the migration state and wages at home (“stayer state”), respectively, and C_i are the associated costs of moving. Following the literature, we suppose that a worker’s propensity to migrate depends on a linear combination of the wage differentials as well as individual, X_i , and state, Z_s , characteristics:

$$I_i = \alpha_0 + \alpha_1[Y_{mi} - Y_{si}] + \alpha_2 X_i + \alpha_3 Z_s + \epsilon_i. \quad (3.2)$$

As discussed, the econometrician cannot observe outcomes for an individual in both the migrant state (Y_{mi}) and the stayer state (Y_{si}). To overcome the self-selection problem, we first estimate a maximum likelihood Heckman (1979) selectivity correction. Our baseline estimation is as follows. The migration selection equation includes worker characteristics such as gender, age, and educational attainment as well as state-level characteristics such as urbanization rates, the log of per capita GDP, the log of state-average wages, and state-level log of value added in agriculture, manufacturing, and services as regressors. The wage outcome equation excludes state-level characteristics under the assumption that worker and employer characteristics exhaustively predict earnings.

Table 3.6 presents the results from maximum likelihood estimation. Column (1) reports selectivity-corrected coefficients for our baseline specification. All regressors in the outcome (wage) equation are highly significant and exhibit the expected sign.⁹ Worker-specific variables in the migration equation are highly significant and corroborate the evidence from section 3.3.4: women are less likely to migrate than men; workers with at least some college are more likely to migrate than less-educated workers; migration is decreasing in age. State-level information is also largely consistent with the literature: the higher is the state’s urbanization rate, log state-average wages, and the state’s log value added in agriculture and manufacturing, the less likely is a worker to migrate. Interestingly, GDP per capita at t correlates significantly positively with migration. A worker is more likely to migrate within the formal sector if he resides in a high income state, in contrast to common priors. This result, however, does not necessarily run contrary to commonly found regional migration patterns: states like Goias

⁹Women earn 41 percent less than men; wages are increasing in the level of education and increasing with age, at a decreasing rate.

Table 3.6: Maximum Likelihood Estimates of Selectivity-Corrected Wage Coefficients

Dependent Variable: Log Wages in $t + 1$	(1)	(2)	(3)	(4)
Female	-0.408** (0.019)	-0.417** (0.020)	-0.250** (0.016)	-0.192** (0.016)
High School Graduate	0.463** (0.011)	0.445** (0.011)	0.223** (0.010)	0.223** (0.011)
Some College	1.183** (0.026)	1.152** (0.025)	0.592** (0.021)	0.527** (0.022)
College Graduate	1.640** (0.018)	1.610** (0.018)	0.932** (0.016)	0.894** (0.017)
Age at $t + 1$	0.065** (0.003)	0.066** (0.003)	0.033** (0.002)	0.027** (0.003)
Age at $t + 1$ Squared	-0.001** (0.00004)	-0.001** (0.00004)	-0.0003** (0.00003)	-0.0002** (0.00003)
Selection Equation: Migrate				
Female	-0.337** (0.007)	-0.337** (0.007)	-0.335** (0.007)	-0.334** (0.007)
High School Graduate	-0.017* (0.007)	-0.017* (0.007)	-0.011 (0.007)	-0.006 (0.007)
Some College	0.132** (0.015)	0.132** (0.015)	0.142** (0.015)	0.152** (0.015)
College Graduate	0.087** (0.010)	0.087** (0.010)	0.095** (0.010)	0.107** (0.010)
Age at t	-0.010** (0.0003)	-0.010** (0.0003)	-0.010** (0.0003)	-0.010** (0.0003)
Urbanization at t	-0.131** (0.049)	-0.131** (0.049)	-0.134** (0.049)	-0.136** (0.050)
GDP Per Capita at t	0.076** (0.009)	0.076** (0.009)	0.078** (0.009)	0.077** (0.009)
Log Average State Wages at t	-0.209** (0.029)	-0.209** (0.029)	-0.209** (0.029)	-0.202** (0.030)
Log Value Added in Agriculture at t	-0.010** (0.004)	-0.010** (0.004)	-0.012** (0.004)	-0.013** (0.004)
Log Value Added in Manufacturing at t	-0.097** (0.009)	-0.097** (0.009)	-0.095** (0.009)	-0.092** (0.009)
Log Value Added in Services at t	0.050** (0.012)	0.050** (0.012)	0.049** (0.012)	0.046** (0.012)
Fixed Effects: State at $t + 1$		YES	YES	YES
Establishment Controls at $t + 1$			YES	YES
Establishment Controls at t				YES
Number of Observations	1,005,010	1,005,010	1,004,549	1,003,876

Note: Establishment controls include average wages, number of workers, the share of female workers, and the share of workers in eight age groups, four education groups, and five occupational groups. Robust standard errors in parentheses. ** denotes significance at 1 percent level; * denotes significance at 5 percent level.

Sources: RAIS (1-percent random sample) and IBGE, 1997-2001.

often attract workers from states with higher per capita GDP, such as Minas Gerais and the capital city (Distrito Federal). Similarly, many migrants from São Paulo arrive in the neighboring state of Paraná, despite the lower per capita GDP. The sign is also consistent with the economic rationale that skilled formal-sector emigrants from high-income states may expect to find formal-sector jobs with steeper or more certain wage paths at employers in lower-income states. Column (2) includes controls for state-level dummies.

We augment our baseline specification to include employer-level controls both before and after the migration decision. Identification of the selectivity-corrected coefficients in column (2) derives from the excluded state-level sectoral compositions in the outcome equation. By including employer-level information, these state-level characteristics arguably matter less for wage determination, but are still important factors for migration. Column (3) presents results with employer controls after the migration decision in the outcome equation, and the specification in column (4) also includes establishment controls before the migration decision in the outcome equation. Establishment controls are average log wages, the log number of workers, the share of female workers, and the share of workers in six age groups, four education groups, and five occupational groups.

In our preferred specification with employer controls before and after the migration decision (column (4)), all regressors in the wage equation are still highly significant and exhibit the expected sign. After inclusion of employer-level information, the bias-corrected coefficients on the individual characteristics move towards zero as expected. Meanwhile, coefficients in the selection equation have changed minimally. The omitted results on employer-level controls in the outcome equation (not reported) are consistent with priors—employment at an establishment with higher average wages both before and after migration is positively correlated with a worker's wages.

We predict bias-corrected wages for workers in all 27 Brazilian states as migrants and stayers with the coefficient estimates from column (4) of table 3.6. We follow the Dahl (2002) methodology that extends Roy (1951) to multi-choice migration decisions by grouping workers with similar characteristics into worker cells. We define cells by

eight age categories¹⁰, two gender categories, and four education categories.¹¹ Our so transformed data set includes 135,044 cells with an average of 187 workers per cell.

We generate a matrix of migration probabilities calculated for each state s as the fraction of workers in the cell who migrate from state s to state m in year t . We then adapt equation (3.2) to include M_{csm} , the probability that a worker from cell c migrates from state s to state m , as follows:

$$M_{csm} = \alpha_0 + \alpha_1[\hat{Y}_{cm} - \hat{Y}_{cs}] + \alpha_2 X_c + \alpha_3 Z_s + \epsilon_{csm}, \quad (3.3)$$

where c denotes the 135,044 cells, \hat{Y}_{cm} and \hat{Y}_{cs} are computed as the cell-average of the bias-corrected predicted wages from the Heckman (1979) selectivity correction for migrants and stayers, X_c includes cell characteristics (gender, age, educational attainment), and Z_s includes state-level characteristics.

For the purpose of this study on the relationship between formal-sector migration and recent market-oriented policy reforms in Brazil, our main specification augments equation (3.3), such that X_c includes cell-average employer characteristics. For instance, our analysis relates the following predictors to cell c 's probability of migration: the share of workers in cell c employed at a foreign-owned establishment, the share of workers in cell c employed at an exporting establishment, and the cell-average establishment-level tenure-wage profile. We measure the tenure-wage profile as the gradient between establishment-average wages for workers with less than a year of tenure and establishment-average wages for workers with 30 years of tenure. We also augment the vector Z_s to include state-level globalization-related characteristics, such as the state share of foreign-owned establishments, the state share of exporting establishments, state-level log of exports, and state-level log of imports, as additional regressors. The latter exports and imports regressors serve as controls for a location's exposure to global competition.

¹⁰Child (10-14 yrs.), Youth (15-17 yrs.), Adolescent (18-24 yrs.), Nascent Career (25-29 yrs.), Early Career (30-39 yrs.), Peak Career (40-49 yrs.), Late Career (50-64 yrs.), and Post-Retirement (65+).

¹¹Primary School (grade 8 or less), High School Graduate (grade 9-12), College Dropout, College Graduate.

3.4.3 Globalization and formal-sector migration

Table 3.7 reports results from ordinary least squares estimation of equation (3.3). We regress worker cell migration probabilities on cell characteristics and state characteristics, pooling the migration probabilities of all cells from all states s to all states m . All regressions are weighted by the number of workers in each cell and standard errors are clustered at the emigration-state-level to account for spatial correlation of errors.

Column (1) reports estimation results for a simple model in which interstate wage differentials and worker characteristics may be related to the migration decision. The result, after controlling for worker characteristics like gender, age, and educational attainment, and using selectivity-corrected wage differentials, suggests that interstate wage differentials are positively correlated with a worker's decision to migrate. A one percentage-point increase in the spot wage differential is associated with a 0.2 percent increase in the probability of cross-state migration. The remaining cell-specific variables are highly significant and corroborate the evidence from section 3.3.4: women are less likely to migrate than men, while the probability of migration is increasing in the level of education and decreasing in age. In column (2), we add emigration-state fixed effects, emigration-state time-varying controls, and emigration-establishment controls, including the cell-average establishment-level 30-year tenure-wage profile. The expectation of higher future wages in the current establishment significantly reduces the likelihood of migration, and the interstate wage differential remains significantly positively correlated with the migration frequency.

Specification (3) introduces employer characteristics related to globalization, including the share of the cell employed in a foreign-owned establishment and the share of the cell employed in an exporting establishment. Employment at a multinational firm is not statistically significantly associated with migration. But results suggest that employment at an exporting establishment is negatively related to internal migration. A one standard deviation (approximately 10 percentage points) increase in the share of the cells employed at exporting establishments is associated with a 3-percentage point decrease in the probability of migration. This finding is consistent with the idea that the business success of exporting establishments informs workers' migration decisions.

Including state-level controls related to globalization in column (4) offers similar

Table 3.7: Formal-Sector Migration in Brazil

Dependent Variable: Migration Probability	(1)	(2)	(3)	(4)	(5)
Job Characteristics					
Predicted Wage Diff. ($\hat{Y}_{cm} - \hat{Y}_{cs}$)	0.002** (0.0003)	0.002* (0.001)	0.002* (0.001)	0.002* (0.001)	-0.0002 (0.0006)
Employer Characteristics					
Tenure-Wage Profile in t		-0.004* (0.002)	-0.004* (0.002)	-0.004* (0.002)	-0.005 (0.004)
Tenure-Wage Profile in $t + 1$					0.001 (0.005)
Employed in a Foreign Establ. in t			0.001 (0.001)	0.001 (0.001)	-0.001 (0.001)
Employed in a Foreign Establ. in $t + 1$					0.002 (0.001)
Employed in an Exporting Establ. in t			-0.003** (0.0004)	-0.002** (0.0004)	-0.001 (0.001)
Employed in an Exporting Establ. in $t + 1$					-0.003** (0.001)
State Characteristics Related to Globalization					
Share of Foreign Establishments in t				0.004 (0.013)	-0.010 (0.024)
Share of Foreign Establishments in $t + 1$					0.175* (0.072)
Share of Exporting Establishments in t				-0.023 (0.040)	-0.040 (0.056)
Share of Exporting Establishments in $t + 1$					-0.059** (0.016)
Worker controls	YES	YES	YES	YES	YES
Emigration-establishment controls		YES	YES	YES	YES
Emigration-state fixed effects		YES	YES	YES	YES
Emigration-state controls		YES	YES	YES	YES
Immigration-establishment controls					YES
Immigration-state controls					YES
Number of Observations	135,044	103,688	103,688	103,688	102,570

Note: Worker cells formed by eight age, two gender, and four educational-attainment categories. State-level controls include urbanization rates, GDP per capita, average state wages, value added from agriculture, services, and manufacturing, exports and imports. Establishment controls include average wages, number of workers, the share of female workers, and the share of workers in eight age groups, four education groups, and five occupational groups. Regressions are weighted by cell size. Robust standard errors, clustered at the state-level, in parentheses. ** denotes significance at 1 percent level; * denotes significance at 5 percent level.

Sources: RAIS (1-percent random sample), IBGE, RDE-IED, and SECEX, 1997-2001.

conclusions. The share of the cell employed at an exporting establishment remains negatively correlated with the probability of migration. Controlling for the share of exporting establishments in the state, an increase in the share of the cell employed at an exporting establishment of ten percentage points (one standard deviation) relates to a 2-percentage point decrease in the probability of migration.

Descriptive evidence in table 3.4 shows that workers at exporters and multinational enterprises are markedly more likely to move to another exporter or multinational enterprise, when changing jobs, than workers at non-exporters or domestic establishments. A concern is therefore that omitting variables related to the worker's employment and location after migration could drive results in columns (1) through (4). We address the concern by including variables for the immigration state and immigration establishment in specification (5).¹² Employment at an exporting establishment in the initial year continues to be negatively related to internal migration, and similar in magnitude, though it loses significance. Migration is significantly negatively related to employment at an exporter after the migration decision and the share of exporters at the immigration location. These results are in line with evidence in table 3.4 that non-migrants with a job change more often find re-employment at exporting establishments than migrants. Migration is significantly positively related with a larger share of multinational enterprises at the immigration location, however. A ten-percent increase in the concentration of foreign-owned establishments at potential immigration locations is associated with a 1.8-percentage point increase in the migration rate. This result is consistent with the idea that locations that attract multinational enterprises are also economically appealing locations for internal formal-sector migrants.

The results of our multivariate analysis, as well as the descriptive findings in section 3.3.4, provide support for the idea that globalization acts on internal migration through the growth of employment opportunities at locations with a high concentration of foreign-owned establishments and the stability of employment at exporting establishments:¹³ a ten-percentage point increase in exporter employment relates to a 2-

¹²A more rigorous treatment of immigration-employer and immigration-state predictors would require estimation of differences in emigration-immigration characteristics similar to the two-step approach for spot wages. The derivation and implementation of an according statistical model remains a task for future research.

¹³Results from regressions by region (not reported) illustrate these points further.

percentage point reduced probability of migration, and a ten-percent increase in the concentration of foreign-owned establishments at potential immigration locations relates to an about equal-sized increase in the migration rate. The importance of the presence of foreign-owned establishments in the immigration region, beyond the spot wage, is consistent with the economic rationale that migrants can expect benefits beyond the spot wage differential, such as steeper wage paths at foreign-owned establishments (figure 3.3) or more favorable labor-market conditions in areas where multinational enterprises locate. The magnitudes of the migration flow changes, predicted by exporter employment and the concentration of foreign-owned establishments at the destination location, are potentially large, given an annual overall migration rate of only two percent.

3.5 Concluding Remarks

This chapter investigates how factors related to globalization are associated with internal migration flows in a developing country. Using a novel matched data set of workers and their establishments across all states of Brazil, we show that formal-sector internal migration flows are positively related to a high concentration of foreign-owned establishments at the destination location, while workers with employment at exporting establishments are less likely to migrate. Our estimation approach corrects for self-selection of migrants and controls for interstate wage differentials as well as worker and state characteristics. Rigorous identification strategies for the causal effects that destination-locations characteristics exert on migration flows are beyond the scope of this descriptive chapter, however. A potentially fruitful path for analysis is the estimation of differences in emigration-immigration characteristics similar to our two-step approach for spot wages, based on Dahl (2002). The derivation and implementation of an according statistical model remains a task for future research.

Findings of our descriptive analysis are consistent with the idea that globalization acts on internal migration through the growth of foreign-owned establishments and employment opportunities beyond spot wage differentials and the stability of employment at exporting establishments. Given annual formal-sector migration rates of around

two percent, the magnitude of globalization-predicted migration flows are potentially large. A one-percentage point increase in exporter employment is associated with a 0.2-percentage point reduced probability of migration, and a one-percent increase in the concentration of foreign-owned establishments at potential migration destinations relates to an about equal-sized increase in the migration rate.

Recent research advances the hypothesis that return migration may be a leading cause of the large and unprecedented flows of people from Southern to Northern regions in Brazil (see Fiess and Verner (2002) for a discussion and an opposing view based on evidence from a household cross section). Our findings support the view that the frequent location of foreign-owned and exporting establishments in the Northern and Northeastern states may be a reason for return migration from the South and Southeast.

This chapter is based on *The Impact of Globalization on Formal-Sector Migration in Brazil*, joint with Ernesto Aguayo-Tellez and Marc-Andreas Muendler.

Appendix A

Appendix - Chapter 1

A.1 Constructing the Sample

For the purpose of this study, I identify workers displaced from multinational establishments and subsequently rehired at domestic-owned establishments. Using the common establishment tax identification codes in both the RAIS and RDE-IED data sets, I identify foreign-owned establishments and domestic-owned establishments as described in the data section 1.4.2. In this section, I describe my efforts to identify workers displaced from multinational establishments, the domestic-owned establishments at which they were rehired, and the incumbent domestic workers at the hiring domestic establishments.¹

Step 1: Identify Displaced Multinational Workers Matching the establishment tax identification code in RAIS and RDE-IED, I identify all employees of multinational establishments. The RAIS database includes an indicator for employment on December 31. To identify workers displaced from multinational establishments, I keep workers employed in multinational establishments at some time in year t , but no longer employed on December 31 of that year. Furthermore, with information on the reason for job separation, I keep only those workers who left the job involuntarily, i.e., who were laid off.

¹As part of my empirical strategy, I also control for other domestic workers entering the establishment to control for general hiring trends. Therefore, step 1 also applies to displaced domestic-owned establishment workers.

Step 2: Identify Domestic Establishments The full employment history in RAIS allows me to track the worker beyond employment at the multinational establishment. Once an employee has received training from a multinational establishment in year t , he may transfer it to *any* establishment j he may become employed in in year $\tau \geq t$. I collect the set of establishments j in each year t and generate the share of the workforce with any previous employment spell in a multinational establishment.²³

Step 3: Identify Incumbent Domestic Workers With the complete set of hiring domestic-owned establishments, I identify the set of incumbent domestic workers in the domestic establishments in each time period. I include only workers who remain in the establishment over the sample period. I focus on the retained worker to ensure pure spillover effects and not compositional effects.

The final matched worker-establishment database includes the full employment history of incumbent domestic formal-sector workers in domestic-owned formally-registered establishments in Brazil from 1996 through 2001. Because the sample is limited to domestic-owned establishments and their employees, it is not subject to the endogeneity problem inherent to many studies of multinational spillovers that occurs when comparing foreign and domestic firms—that is, that foreign investors may choose to invest in establishments that perform better.

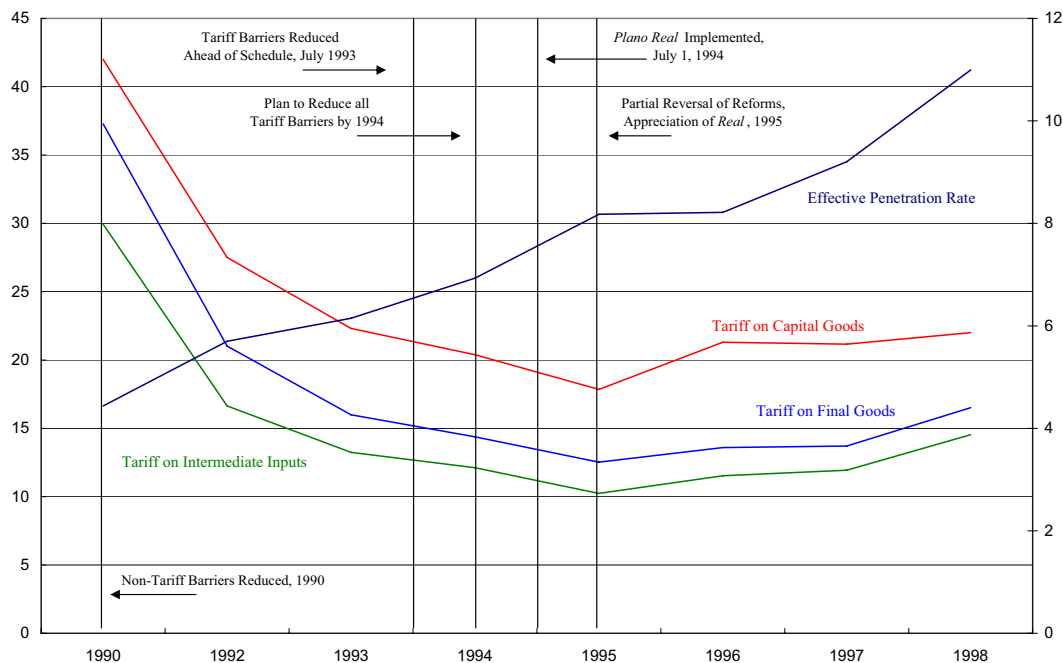
A.2 Brazilian Policy Reforms

The marked increases in foreign investment inflows were largely a result of macroeconomic stabilization policies which brought down inflation levels, trade liberalization policies which encouraged foreign firms to locate in Brazil, a national privatization program, and a federal deregulation program.

Macroeconomic Stabilization After a decade of rising inflation and a number of attempts to stabilize the economy, on July 1, 1994, the Brazilian government implemented the *Plano Real* to end years of hyperinflation. In the twelve months that preceded the

²If the worker was hired by another multinational establishment, the observation is excluded from the analysis (as are all multinational establishments).

³The assumption that MNE switchers may take knowledge to all subsequent establishments is not used for domestic switchers. A worker is a domestic switcher only for the first establishment he enters subsequent to his initial displacement.



Source: Muendler (2003)

Figure A.1: Brazilian Protection Rates and Foreign Competition, 1990-1998

introduction of the new currency, inflation had reached 5,154 percent per annum. By 1998, annual inflation was only 1.7 percent. Pineiro, Giambiagi and Moreira (2001) remark that Brazil had the same inflation rate for a year that it had in a single day prior to the Real Plan. The drop in inflation allowed for increased efficiency and competition and attracted significant foreign direct investment.

Trade Liberalization The late 1980s and early 1990s witnessed sweeping changes in Brazilian trade policy. Figure A.1 charts the decline in Brazil's average tariff rates and rise in effective rates of penetration over the 1990s, alongside major policy reforms over the 1990s.⁴ Beginning with the Collor de Mello administration and continuing with

⁴Muendler (2003)

President Cardoso, Brazil began extensive policies of trade liberalization which paved the way for bilateral trade agreements and multilateral free trade areas with the Southern Cone countries of South America. Brazil's entry into MERCOSUL in 1991 was instrumental in beginning to attract greater inflows of FDI to the country as a regional export base for multinational firms (Pineiro and Moreira (2000)).

Privatization Program In March 1990, President Fernando Collor de Mello launched the National Privatization Program (PND) under the auspices of Law No. 8,031, but it was the Cardoso administration which placed a high priority on the privatization of public services ending the discrimination against subsidiaries of foreign companies. Purchases by foreign investors reached 53 percent of the total privatization sales between 1995-2001 (BNDES (2003)).

Federal Deregulation Program With the intention of increasing competition among domestic producers, the Collor de Mello administration instituted the Federal Deregulation Program. Among other reforms were the elimination of legal restrictions limiting market entry into specific non-tradeable sectors by foreigners. At this time, foreign firms were also given national treatment in access to domestic preferential public credit markets.

A.3 Supplemental Tables

Table A.1: ISCO Skill-Intensity of Occupation, By Major Group

Major Group	Description	Skill Level	Definition
1	Legislators, senior officials, and managers	4	Professional and Technical
2	Professionals	4	Professional and Technical
3	Technicians and associate professionals	4	Professional and Technical
4	Clerks	3	Other White Collar
5	Service workers and shop and market sales workers	3	Other White Collar
6	Skilled agricultural and fishery workers	2	Skilled Blue Collar
7	Craft and related workers	2	Skilled Blue Collar
8	Plant and machine operators and assemblers	2	Skilled Blue Collar
9	Elementary occupations	1	Unskilled Blue Collar

Source: International Standard Classification of Occupations.

Appendix B

Appendix - Chapter 2

B.1 U.S. Trade Missions

The Department of Commerce sponsors trade missions with the objective of fostering the U.S. export market. Trade missions are defined as “missions involving travel to foreign countries by private sector participants and Commerce Department employees in which the Commerce Department recruits and selects participants from the business community.” In 2003, the United States organized 27 trade missions overseas reaching 32 countries, and 2 “inward” trade missions in which prospective importers traveled to the United States from abroad. A typical trade mission is attended by 10 to 15 delegates. Government regulations require that all costs incurred by the Department on behalf of the trade mission participants be recovered in full from the participants. These fees are often expensive for small and medium-sized businesses wishing to enter a new market. However, many small grants are available to firms to cover these costs through the government’s Small Business Administration Grant Resources.

Other export promotion strategies by the U.S. government include the U.S. Trade and Development Agency (USTDA) which directly funds approximately 45 “orientation visits” each year with the purpose of bringing foreign buyers to the United States to become familiar with products for future purchases. U.S. suppliers participating in the visits showcase their products, expertise, and make valuable international contacts. The Special American Business Internship Training Program (SABIT) facilitates firms’ foreign market access by funding grants to host foreign managers and scientists for tem-

porary professional training in the United States. The program argues “while many international markets are full of opportunity, there are an equal number of risks that must be managed for this potential to be realized. SABIT manages innovative training programs that reduce market access barriers and minimize commercial risks for organizations interested in market opportunities.”

B.2 Survey of International Air Travelers

The survey program was initiated in the early 1980s by the U.S. Travel and Tourism Administration (USTTA) in response to a growing need for information on the volume, characteristics, and travel patterns of international travelers to and from the United States.¹ Airline involvement is on a voluntary basis among airlines invited to participate.² Participating airlines are selected at random from the list of major airlines which voluntarily choose to participate in the program. Flight packages containing approximately 100 questionnaires are distributed onboard U.S. outbound flights to international destinations in twelve languages.³

The survey results are weighted to represent the population of travelers to and from the United States based on the Immigration and Naturalization Service (INS) I-92 Form for U.S. residents and the Department of Homeland Security (DHS) I-94 Form for overseas residents. The I-92 Form must be completed for all arriving and departing flights from the United States with the complete number of passengers aboard by citizenship. Each U.S. resident respondent is given a weight based on citizenship information and departure and arrival city pairs. The I-94 Form is required for most non-U.S. resident travelers arriving in the United States. This provides a count of the population of overseas residents by citizenship at specific ports of entry (customs information) with which to weight individual respondents.

¹In April 1996, the USTTA was closed due to a lack of funding and the responsibility of the survey was transferred to the OTTI.

²Factors influencing the selection of an airline for an invitation to participate in the survey include the airline’s market share in the geographic area under consideration, the desirability to have both a U.S. and foreign flag carrier for each area, and the necessity to keep costs at a minimum.

³Arabic, Chinese, English, French, German, Italian, Japanese, Korean, Polish, Portuguese, Russian and Spanish.

B.3 Supplemental Tables

Table B.1: United States Country Sanctions Programs, Through 2003

Target Country	Beginning Date	Ending Date	Rationale
Afghanistan	July 4, 1999	July 3, 2002	Taliban
Angola	September 26, 1993	May 7, 2003	UNITA
Burma/Myanmar	May 20, 1997	Present	“repression of democratic opposition”
Cambodia		November 25, 1994	
China		Present	Tienanman Square Massacre
Cuba	July 8, 1963	Present	“hostile actions by Cuban government”
Haiti		October 16, 1994	
India	June 1998	Present	nuclear testing
Iran	October 29, 1987	Present	“support for international terrorism”
Iraq	August 2, 1990	July 30, 2004	“invasion of Kuwait”
Liberia	May 23, 2001	January 15, 2004	“illicit diamond trade”
Libya	January 7, 1986	September 20, 2004	
North Korea	January 1, 1950	Present	
Pakistan	June 1998	Present	nuclear testing
Rwanda	May 26, 1994	Present	arms embargo
Sierra Leone	January 19, 2001	January 15, 2004	“illicit diamond trade”
South Africa		May 1994	UN arms embargo; apartheid
Sudan	November 4, 1997	Present	“support for international terrorism”
Vietnam		March 6, 1995	
Yugoslavia	May 30, 1992	May 29, 2003	Kosovo

Source: Malloy (2001); U.S. Department of the Treasury, Office of Foreign Assets Control.

Table B.2: Countries in Sample

Africa	Central America	South America	Europe
Algeria	Belize	Argentina	Albania
Angola	Costa Rica	Bolivia	Armenia
Benin	El Salvador	Brazil	Austria
Botswana	Guatemala	Chile	Azerbaijan
Cameroon	Honduras	Colombia	Belarus
Cape Verde Is.	Nicaragua	Ecuador	Belgium
Congo	Panama	Guyana	Bosnia-Herzegovina
Eritrea		Paraguay	Bulgaria
Ethiopia	Caribbean	Peru	Croatia
Gabon	Antigua & Barbuda	Uruguay	Czech Republic
Gambia	Bahamas	Venezuela	Denmark
Ghana	Barbados		Estonia
Guinea	Bermuda	Asia	Finland
Ivory Coast	Dominican Rep.	Bangladesh	France
Kenya	Grenada	Bhutan	Georgia
Lesotho	Haiti	Cambodia	Germany
Madagascar	Jamaica	China	Greece
Malawi	St. Kitts	Hong Kong	Hungary
Mali	St. Lucia	India	Iceland
Mauritania	St. Vincent & Grenadines	Indonesia	Ireland
Mauritius	Trinidad & Tobago	Japan	Italy
Morocco		Kazakhstan	Latvia
Mozambique	Middle East	Korea	Lithuania
Namibia	Bahrain	Krygyzstan	Luxembourg
Niger	Cyprus	Laos	Macedonia
Nigeria	Egypt	Macau	Malta
Senegal	Iran	Malaysia	Moldova
Seychelles	Israel	Maldives	Netherlands
Sierra Leone	Jordan	Mongolia	Norway
South Africa	Kuwait	Nepal	Poland
Swaziland	Lebanon	Pakistan	Portugal
Tanzania	Oman	Philippines	Romania
Tunisia	Qatar	Singapore	Russia
Uganda	Saudi Arabia	Sri Lanka	Serbia
Zambia	Syria	Thailand	Slovakia
Zimbabwe	Turkey	Turkmenistan	Slovenia
	United Arab Emirates	Uzbekistan	Spain
Oceania & Other	Yemen	Vietnam	Sweden
Australia			Switzerland
Fiji			Ukraine
French Polynesia			United Kingdom
New Zealand			
Papua New Guinea			
Tonga			
Western Samoa			

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