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INTERNATIONAL BUSINESS TRAVEL:
AN ENGINE OF INNOVATION?

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ABSTRACT

While it is well known that managers prefer in-person meetings for negotiating deals and selling their products, face-to-face communication may be particularly important for the transfer of technology because technology is best explained and demonstrated in person. This paper studies the role of short-term cross-border labor movements for innovation by estimating the recent impact of U.S. business travel to foreign countries on their patenting rates. Business travel is shown to have a significant effect up and beyond technology transfer through the channels of international trade and foreign direct investment. On average, a 10% increase in business travel leads to an increase in patenting by about 0.3%. We show that the technological knowledge of each business traveler matters by estimating a higher impact for travelers that originate in U.S. states with substantial innovation, such as California. Moreover, the business traveler effect on innovation also varies across industries. This study provides initial evidence that international air travel may be an important channel through which cross-country income differences can be reduced. We also discuss a number of policy issues in the context of short-term cross-border labor movements.

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1 Introduction

Throughout history the cross-border flows of workers had major effects on the innovative activity and growth of countries. In the year 1789, for example, at a time when England had banned the international movement of skilled craftsmen so as to keep important technology from spreading, a certain Samuel Slater succeeded to disguise himself and slipped out on a ship to the United States, where he built the first water-powered textile mill and became known as the father of the American Industrial Revolution. Today blueprints can be transferred electronically over the Internet, or technologies are shipped at relatively low costs as capital goods. Does this mean that cross-border labor movements play no role anymore for innovation? In this paper we provide new evidence on this question by studying the impact of short-term business travel.

Cross-border worker flows bring domestic entrepreneurs into personal contact with foreigners who are familiar with foreign technology. Domestic innovation may rise because innovation is incremental, and knowledge of prior art helps. Technology is also often tacit–it is difficult to fully characterize–, and face-to-face communication is more effective than other forms for transferring technology.[1] Nevertheless we know quite little on the impact of cross-border worker flows on innovation. In this paper, we employ a new industry-level dataset to examine the impact of business travelers from the United States on patenting in 36 countries over the period of 1993 to 2003. Our main finding is that business travelers coming to a country have a positive impact on that country's rate of innovation. Quantitatively, a 10% increase in business travelers increases

[1] Polanyi (1958) discusses the tacitness of technological knowledge. See Koskinen and Vanharanta (2002) on the role of face-to-face communication in overcoming problems arising from the tacitness of technology, and Forbes (2009) as well as Harvard Business Review (2009) on the general preference of business executives for face-to-face meetings over phone or web-based communications.

patenting on average by about 0.3%, and in the typical case business travel from the United States accounts for about 1% of the total difference in patenting across countries. Moreover, we find evidence that the impact of inward business travel on patenting is increasing in the technological knowledge carried by each particular traveler.

While international trade in goods and foreign direct investment (FDI) have long been the subject of investigation, there is much less research on international trade in services, even though by now services trade is substantial in many countries. For example, services exports are now close to 40% of U.S. goods exports.[2] This paper sheds new light on the impact of international air travel. This provides new information for the gains from services liberalizations, both bilaterally (such as the Open Skies Agreement) and multilaterally among the members of the World Trade Organization.[3] While researchers have started to look at the role of international business travel in facilitating goods trade (Poole 2010, Cristea 2011), we examine the role of business travel on innovation taking the trade in goods as well as FDI as given.

The diffusion of knowledge and ideas is central to macroeconomics because of its implications for the long-run convergence of incomes (Lucas 1993, Aghion and Howitt 1998, Howitt 2000, Jones 2002, and Alvarez, Buera, and Lucas 2008). It is an open question whether knowledge can be transferred exclusively in disembodied form (as a blueprint) or whether knowledge transfer also requires the movement of people, for example the Western settler migration that brought new ideas of institutions to the New World (Acemoglu, Johnson, and Robinson 2001). In some recent research knowledge is indeed assumed to be fully embodied in people (Burstein and

[2] News release of the U.S. Bureau of Economic Analysis, May 11, 2011.

[3] The Open Skies Agreement seeks to liberalize air travel to and from the United States, see http://www.state.gov/e/eeb/tra/ata/. WTO (2006) discusses key multilateral issues.

Monge-Naranjo 2009) so that international travel is crucial for knowledge diffusion.

The importance of personal contacts for international technology transfer has been established in micro empirical work by a number of researchers. Common ethnicity may lower the cost of transferring knowledge from one country to another (Kerr 2008).[4] Moreover, movements of scientists themselves can be a conduit of international knowledge flows (Oettl and Agrawal 2008, Kim, Lee, and Marschke 2006). While we focus on knowledge transfer that comes about through face-to-face meetings in a large number (more than 100,000) of business trips, these papers are complementary to our research.

There are a few papers that have considered air travel as a conduit for technology transfer. Results have been mixed. Gambardella, Mariani, and Torrisi (2009) in their analysis of European regions find that air passengers are not significantly related to productivity differences once other determinants are controlled for. In contrast, Andersen and Dalgaard (2011) employ World Tourism Organization data to show that the number of air travelers relative to population can explain cross-country productivity differences, though a concern is that the definition of travel in these data varies.[5] In this paper we focus on travel data collected by a single country (the United States), which ensures the consistency of the data across countries. We can also separate business from leisure travelers, which is important because leisure travelers should matter much less for technology transfer. In addition, our research is unique in analyzing the impact of business travel on patenting, as opposed to productivity. While patenting is not the ideal measure of technology transfer, its relative simplicity makes it less prone to confounding factors, which is a

[4] Network membership often lowers the costs of interaction (Rauch 2001), and to verify membership face-to-face meetings will often be useful. See also Singh (2005), Agrawal, Cockburn, and McHale (2006), and Agrawal, Kapur, and McHale (2008).

[5] See also the work by Le (2008) and Dowrick and Tani (2011).

plus at a time when the literature is only emerging.[6]

The remainder of the paper is as follows. The next section gives an overview of the empirical analysis and also highlights important aspects of the estimation methods. Section 3 describes the data that will be used, with more details given in the Appendix. All empirical results are presented in section 4, while section 5 contains a concluding discussion of our findings.

2 An empirical model of innovation through cross-border movements

We are interested to estimate the impact of international business travel on the rate of innovation across countries and industries. Innovation is measured in terms of the countries' patents at the level of 37 industries. The industry dimension is important because industries vary greatly in terms of patenting activity. While patent data is available even by industry, information on business travel is much more scarce. This paper employs data on outward business travel of U.S. residents (who are predominantly U.S. citizens) to other countries.[7] The focus on one source country means that the spells of business travel are more comparable than if we had used data from multiple countries that might use different approaches in data collection. Moreover, we limit the analysis of patenting to patent applications in the United States, both to ensure a common quality standard across countries and because the United States is an important market for all of the countries in our sample.

[6] Productivity as it can typically be measured captures not only technical efficiency but also demand shocks and market power, factor market distortions, and product mix changes (Foster, Haltiwanger, and Syverson 2008, Hsieh and Klenow 2009, and Bernard, Redding, and Schott 2010, respectively). See Keller (2004) for more discussion on measures of technology and technology diffusion.

[7] Thanks go to Jennifer Poole who shared the outcome of her NSF-funded data collection with us.

Our approach is straightforward. We hypothesize that patenting in a particular country c in industry i, P_{ci} is some unknown function Ψ of inward business travelers from the United States, B_c and of other observed and unobserved determinants, Z_c :

$$P_{ci} = \Psi\left(B_c, Z_c, \Theta\right), \tag{1}$$

where Θ is a vector of unknown parameters. In estimating equation (1), there are a number of generic problems, including endogeneity, that will be addressed below. A more specific issue to our analysis is the fact that the number of patents, P_{ci}, is a non-negative count variable. Consequently least-squares, which assumes unbounded support, is not appropriate. Instead the analysis will rely on negative binomial regressions, which is a well-established model for count data. The negative binomial model assumes that the dependent variable follows a Poisson-type process. The main difference compared to a Poisson regression is that the negative binomial model does not assume equality between the mean and the variance.[8]

Before presenting the estimation equation and turning to the results, the next section gives an overview of the data.

3 Data

Innovation The dependent variable in our analysis is the number of U.S. patents to foreign country inventors in the years 1993 to 2003 in 37 industries as recorded by the United States Patent and Trademark Office (USPTO). As noted above, focusing on foreign patents in the U.S.

[8]Cameron and Trivedi (1998) discuss count data models more generally; see also the arguments for Poisson-like regression models put forward in Santos Silva and Tenreyro (2006).

ensures that all inventions surpass the same quality standard, and moreover, patent protection in the United States will typically be important for major inventions given the importance of the U.S. market. This data comes from the custom data extracts of the USPTO database, which has information on country of residence for each of possibly several inventors per patent, original USPTO patent classification, as well as the application month and year.[9] In the case of $n > 1$ inventors, we assign a fraction of $1/n$ to each inventors country of residence. Based on USPTO classification, patents are assigned to NBER 37 technological subcategories (or, industries).[10] A list of industries is provided in table A1 of the Appendix. The main dependent variable in the empirical analysis is the sum of these fractional patent counts aggregated by foreign country and industry for each quarter during the period 1993 to 2003.[11]

In addition, we employ the USPTO individual inventor database to separate out foreign patents that have a U.S. co-inventor. These patents are of particular interest because the traveler might in fact be the U.S. co-inventor on that patent. For this reason, we believe that the relationship between business travel and domestic innovation might be particularly strong for these patents. How frequent are patent applications that have a U.S. co-inventor? We find that on average about one in 60 of all foreign patent applications in the United States during the sample period had foreign and U.S. co-inventors.

It is well-known that a principal determinant of the rate of innovation is the country's R&D expenditures. We have obtained this data from OECD Statistics.[12] We also include two other

[9] We focus on the date of application as opposed to the date of when the patent is granted; this ensures that differences in the processing time of patents do not play a role.

[10] See Hall, Jaffe and Trajtenberg (2001).

[11] The use of fractions means that our data is not strictly speaking count data; despite this we prefer to employ count data regression models. More information on the patent data construction is given in the Appendix.

[12] OECD statistics provide Gross Domestic Expenditure on R&D for OECD and also some non-member

measures of innovation, namely a country's total patent applications in a particular year, both by residents of that country as well as by non-residents (source: World Intellectual Property Organization).[13] These variables control for innovative cycles in each country that are general in the sense that they are not specifically related to travel from the United States. In addition, including all patents on the right hand side controls for the patent family effect, namely that a patent application in the U.S. reflects only the fact that a given technology has been invented and patented at home in the same period.

Travel The information on international air travel in this paper comes from the Survey of International Air Travelers (SIAT) which is conducted by the International Trade Administration, U.S. Department of Commerce. This survey provides information on travel from the United States to foreign countries for U.S. residents for each quarter during the years 1993 to 2003. The data has information on the travelers' U.S. county of residence, the foreign city of destination, the purpose of the travel, and the traveler's occupation. Matching this information on travel with other parts of our data set required aggregation, and the basic unit of observation is resident travelers from a U.S. state to a given foreign country for each quarter during the years 1993 to 2003.

While we do not have specific information on the technological knowledge carried by each traveler, we account for differences in this respect by incorporating information on patent stocks (a measure of technological prowess) at the level of the U.S. states and industries. Our business

countries.

[13] The assignment of these patents to countries is based only on the first inventor.

traveler variable, B_{cqti}, is defined as follows:

$$B_{cqti} = \sum_{s \epsilon S} \underbrace{\frac{P_{sqt}}{GSP_{sqt}}}_{State} \times \underbrace{P_{iqt}}_{Industry} \times \tilde{B}_{scqt}, \forall i, q, t, \tag{2}$$

where the variable P_{sqt} is the patent stock of U.S. state s in quarter q of year t, GSP_{sqt} is the state's gross product, P_{iqt} is the patent stock of U.S. industry i in quarter q of year t, and $\tilde{B}_{scqt}$ is the raw (unweighted) number of business travelers from state s to foreign country c in quarter q of year t. Equation (2) captures two dimensions of differences in technological knowledge. First, U.S. travelers coming from a state with a high patent-to-GSP ratio are more likely to affect innovation abroad than travelers that come from low-patenting states. This origin effect is the part labeled *State* in equation (2). Second, a given traveler is more likely to carry knowledge relevant for industry i if that industry in the United States is large in terms of its patenting; this effect is labeled *Industry* in equation (2). The patent figures by state and industry come from the files of the U.S. Patent and Trademark Office (USPTO), and the gross product levels by state come from the U.S. Department of Commerce's Bureau of Economic Analysis. U.S. state and industry-level patent statistics are summarized in Table A2 of the Appendix.

Analogously to the weighted number of business travelers from the United States according to equation (2), we also compute the numbers of travelers who are visitors, are traveling for religious reasons, are retired, or are homemakers. These variables will be employed in our empirical analysis in form of a control function discussed below.

Other variables The size and level of development of a country affects its patenting in the United States, and for this reason we include information on population size and GDP per capita (source: Penn World Tables, version 6.2). It is also important to control for other channels of international technology transfer, such as international trade and FDI (see Keller 2010). The regressions include U.S. exports to each of the sample countries, as well as the total sales of U.S. majority-owned multinational affiliates in each of the sample countries.

Summary statistics of the data are presented in Table 1. The first two rows show some descriptive statistics on fractional patent counts by foreign inventors and joint U.S./foreign patent counts. There is a lot of variation in U.S. patenting by foreign countries and industries as evidenced by the standard deviation in both foreign U.S. patent counts as well as joint U.S. patent counts. A list of the 36 countries that are included in this analysis is given in Table A3 of the Appendix. The following four rows in Table 1 present (in natural logarithms) U.S. resident travel data for business, religious, and visitor purposes, along with data on travelers that are retired and homemakers.[14] As can be seen from the table, the number of travelers for the purpose of business and visitor are close in magnitude, while the number of observations for religious travel and retired and homemaker travel is much smaller.

We now turn to the empirical results.

4 Empirical results

We begin by introducing the estimation equation. It is given by

$$E\left[P_{cqti}|B_{cqti},X_{cqti},Z_{cqti}\right]=\exp\left[\alpha\ln B_{cqti}+\beta\ln X_{cqti}+\mu_c+\mu_q+\mu_t+\mu_i+\varepsilon_{cqti}\right] \qquad (3)$$

[14] In this analysis we focus on positive numbers of business travelers, as our analysis does not necessary apply to patenting in the case when there is no business travel.

where P_{cqti}, the expected patent counts of a country c in the United States in quarter q of year t and industry i is a function of B_{cqti}, the number of business travelers at that time between country c and the U.S. (from equation 2), other determinants X_{cqti} of country c's patenting in the U.S. (such as R&D expenditures), country-, quarter-, year- and industry fixed effects (the μ's), and an error term, ε_{cqti}. In our data, the variance of patents exceeds its mean (overdispersion), and the negative binomial model is generally preferred to the Poisson model in our case.[15]

The initial results on the relation between innovation and U.S. business travel are shown in Table 2. In columns 1 to 5, the dependent variable is the foreign country's patent counts taken out at the U.S. patent office, while in column 6 the dependent variable is foreign patents that have U.S. coinventors. All regressions include country, year, quarter and industry fixed effects. Robust standard errors which allow for clustering by country-year are reported in parentheses.[16] Column 1 shows that there is a strong correlation between patenting and travel from the United States, which is only slightly reduced with the inclusion of controls for size and level of development in column 2: the coefficient on business travel decreases from 0.056 to 0.053.

Next we include controls for domestic technology investments as well as international technology transfer. U.S. FDI and U.S. exports have a positive coefficient, although only FDI is significant. The inclusion of these variables lowers the business travel coefficient slightly. In column 4, we include R&D expenditures, which has a highly significant impact on patenting. With the inclusion of R&D expenditures, U.S. FDI becomes insignificant, while in contrast the

[15] We have also considered 'zero-inflated' negative binomial regressions, however, they do not lead to a major improvement in empirical fit.

[16] We cluster by country-year because some of the variables do not vary by quarter and by industry; for example, GDP per capita for a given year is employed for all four quarters of that year and all industries. In contrast, patents on the left and the business variable on the right-hand side vary by quarter and industry.

coefficient on business travel is largely unchanged.

Recall that the left-hand side variable is a country's industry-level patenting in the United States. In column 5 the patenting of the country in *all* countries of the world is added, where we distinguish resident from non-resident patenting. This controls for technology and other shocks that lead to changes in a country's overall patenting. We see that resident patenting is more strongly correlated with the country's patenting in the United States, a plausible result that holds throughout our analysis. With the inclusion of all control variables, the business travel coefficient is estimated at just under 5%. Population size, domestic R&D expenditures and resident patent applications are associated with higher patenting in the U.S., while neither U.S. FDI nor U.S. exports have a significantly positive effect on the rate of patenting.

We now turn to a preliminary analysis of the economic magnitude implied by these estimates. The size of the business travel coefficient suggests that a 10% increase in business travelers from the U.S. is associated with an about 0.5% higher number of patent applications in the United States. If we focus on foreign patents with U.S. co-inventors, the coefficient estimate for business traveler is about 0.07, see column 6, compared to 0.05 for all U.S. patents in column 5. The finding of a larger coefficient for U.S. business travelers when U.S. persons are co-inventors on certain patents is consistent with stronger international transfer through travel for these technologies.[17]

While endogeneity concerns are reduced through the inclusion of country controls as well as fixed effects, it may still be that the relationship between patenting and business travel is

[17] An interesting result is that U.S. FDI is negative and significant at 10% when the dependent variable is foreign patents with U.S. co-inventors. A possible explanation for this is that if a U.S. person has a joint patent with a foreign inventor, the former is less likely to engage in FDI in that country to protect the invention.

affected by unobserved shocks, which would lead to biased estimates. In particular, we are concerned that $E[B_{cqti}, \varepsilon_{cqti}] > 0$, because this would lead to an upward bias in the business travel coefficient. Our approach is to construct a control function variable, ω_{cqti}, such that when ω_{cqti} is included in the regression the correlation of business travel and the new regression error is zero.[18] The control function that we propose is the residual of a regression of business travel on visitor travel. Consider the following ordinary least-squares regression:

$$\ln B_{cqti} = \gamma_c + \gamma_q + \gamma_t + \gamma_i + \gamma_1 \ln V_{cqti} + \gamma_2 X_{cqti} + \omega_{cqti}, \tag{4}$$

where V_{cqti} is the number of visitor travelers between the U.S. and country c in quarter q of year t and industry i, where visitor travel is defined as travel intended to meet family and friends. The residual $\hat{\omega}_{cqti}$ of this regression will tend to be high when business travel is high relative to visitor travel, conditional on all other covariates. A new direct air connection between a particular U.S. state and a particular foreign country c, for example, will typically lead to an increase in both business and visitor travel. If, in addition, foreign country c improves its business conditions by lowering corporate taxes, this will tend to increase business travel relative to visitor travel. But this would not constitute the exogeneous variation that is needed to estimate the causal impact of business travel on patenting, and it is important that the control function eliminates effects like this. Identification comes from changes in business travel conditional on changes in profitability, technological capability, and other factors that are captured by shifts in the business-visitor traveler relationship. One requirement for this control function approach to

[18] Control function approaches have been widely applied in the estimation of productivity, perhaps starting with Olley and Pakes (1996); Blundell and Powell (2003) give an overview and provide general results on the control function approach.

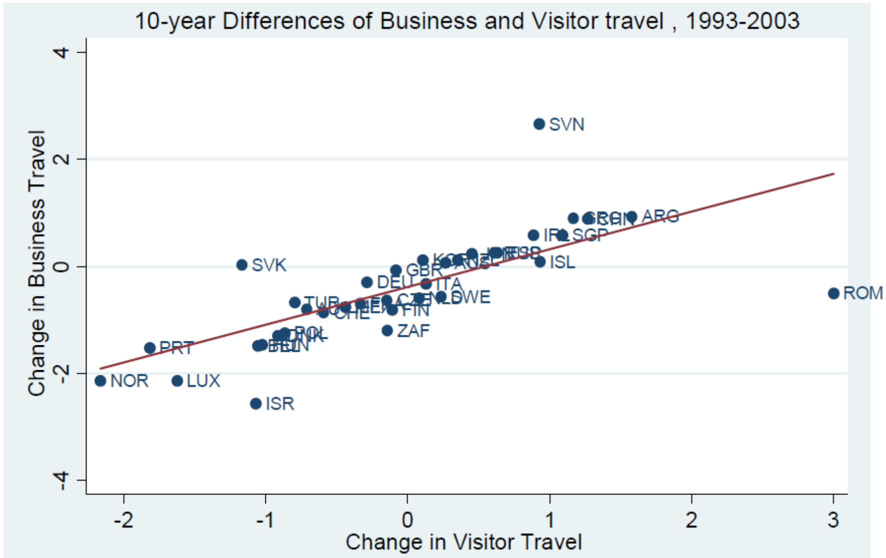

Figure 1:

yield the intended results is that there is a strong correlation between business travel and visitor travel. In Figure 1, we show the 10-year differences for visitor versus business travel. There is a strong correlation, which also exists for shorter periods of time.

The main identification assumption is that visitor travelers do not transfer technology. Of course, visitor travel might convey basic information about foreign countries and their economies. At the same time, we believe that the identification assumption is reasonable because the primary motive of visiting family and friends is to maintain personal relations. While the identification assumption cannot be tested, in Table 6 below we present evidence suggesting that it holds in our context.

Table 3 shows the results from a number of control function regressions (equation 4 above). Column 1 corresponds to visitor travel as the only control variable, while columns 2, 3, 4 and 5 successively include additional control variables, namely the number of persons traveling who are retired, the number of persons who travel for religious reasons, and the number of travelers that are homemakers. As for visitors, persons who travel for religious purposes or are, in terms of their occupation, retired or homemakers, it is reasonable to assume that they are not importantly involved in the transfer of technological knowledge. The results for these regressions indicate that all control variables are positively correlated with business travel, and all with the exception of religious travel are significant. The most important predictor is visitor travel, probably because visitor travel is relatively common, see the summary statistics in Table 1.

Table 4 shows the results when the control functions, $\hat{\omega}_1$ to $\hat{\omega}_5$, for the five columns of Table 3 are included. The first column repeats the baseline results from Table 2, column 5 with a coefficient of 4.9% for the business traveler variable. If endogeneity generates an upward bias in this coefficient, upon inclusion of the control function it is expected that the coefficient on business travel will decrease, and that the coefficient on $\hat{\omega}$ itself is positive. Indeed, we find that the coefficient on the business travel variable falls, from 4.9% in column 1 to around 2.8% and significant in columns 2 to 6. The control function point estimates are between 5.8% and 6.5%, highly significant at 1%. Turning to the results for foreign patent applications in the United States with U.S. co-inventors on the right side of Table 4, we see that the control function correction has qualitatively the same effect on the business travel coefficient, which comes down from about 7 to 6%, while here the control function is not significant. The likely reason for lower precision in the control function is the relatively small set of joint foreign and U.S. patents.[19] Overall, these results indicate that there is a significant effect of business travel on domestic innovation.

[19] When using U.S. joint patents as a dependent variable, visitor only control function turns very small (virtually zero), most likely because of small set of joint foreign and U.S. patents.

What are the economic magnitudes that our estimates yield? Take Austria and Belgium, two countries of similar size and level of development. It turns out that during the sample period covered by the survey around 2,300 business travelers from the United States went to Belgium, compared to just below 1,400 that went to Austria. This overall difference makes for about 3 U.S. business travelers in our sample going to the average industry per year in Belgium, whereas the number of U.S. business travelers per industry and year going to Austria was about 2. At the same time, the mean patenting in Belgium was 5.7, compared to 4.5 in Austria.

We can use our estimates from Table 4 to gauge the importance of international business travel from the U.S. in accounting for this difference of 1.2 in mean patenting. The coefficient on business travel is 0.028, so the predicted patenting premium in Belgium over Austria attributable to the higher number of U.S. business travelers is about 0.012 (equal to $\exp[0.028 \times \ln(3)] - \exp[0.028 \times \ln(2)]$), or about 1% of the total difference. While this is a relatively small number, this effect comes from travel from a single (albeit important) country, the United States. The contribution of travel from *all* countries in explaining variation in the patenting rates across countries is probably a small multiple of that. Another way to assess the economic importance of business travel for patenting is to compare it with domestic R&D expenditures. We calculate that business travel is 1/5 as important as domestic R&D in accounting for patenting differences using marginal effects of our estimated coefficients. Overall, our results suggest that international business travel explains a significant and small to moderate portion of differences in the rate of patenting across countries.

These results come from a large sample of industries, where patenting is much more important is some industries than in others. In the following we examine whether the estimated relationship between business travel and innovation holds for high versus low patenting industries.[20] The results are shown in Table 5. Column 1 repeats for convenience the baseline estimates without the control function (from Table 4, column 1), while in columns 2 and 3 in addition to business travel an interaction of business travel with high patenting dummy (based on median or mean) is included. It is apparent that the impact of business travel on innovation is greater in high patenting industries: the coefficient on business travel in high patenting industries is around 0.3 compared to business travel overall 0.05 (column 1). It is somewhat of a puzzle that business travel has a negative impact in low-patenting industries, however, this may be due to correlation among the independent variables.

In columns 4 to 6, we show analogous results using the preferred control function approach. Baseline estimates with the control function (Table 4, column 6) are repeated in column 4. Columns 5 and 6 present estimates with control function for pure business travel coefficient as well as a separate control function for interaction. The results show that both without and with the control function correction, business travel has a more sizeable effect on innovation in high patenting industries.

Next we perform two important specification checks, see Table 6. In the first part of the table (columns 1-5) we examine the importance of differences in terms of technological knowledge of the travelers, which we account for by weighing travel by the U.S. states' and industry patent stocks (equation 2 above). In columns 1-5 results from employing unweighted business travel variables are shown, in comparison to our baseline (weighted) business travel variable.

[20] In order to correctly identify high versus low patenting industries, we take into account that our sample spans vastly different countries some of which patent more than others. For the following table median and mean of patents are created based on country-industry combination. High patenting dummy is defined to be 1 if patent counts for a given country c in quarter q of year t and industry i is higher than median/mean.

In the basic specification in column 2, the coefficient on business travel is essentially zero as opposed to about 0.03 (Table 4). Specifically, for all foreign patent applications in the U.S., the point estimate falls from 3% to essentially zero. In the case of the foreign patents with U.S. co-inventors, the unweighted business travel estimate is also very small, whereas the patent-stock weighted business travel has a coefficient of about 0.06. We conclude that accounting for technological knowledge heterogeneity is very important in studying the impact of business travel on domestic innovation.

To check the importance of business versus visitor travel, both (weighted) business and visitor travel are included in the same regression, columns 6 and 7 of Table 6. In column 6 where the dependent variable is all U.S. patent applications, with the addition of visitor travel the size of the business travel coefficient increases (still significant) while visitor travel turns negative. This may be due to collinearity of the business and visitor traveler variables shown in Figure 1. In the case with joint foreign/U.S. patents, business travel remains highly positive and significant, while the coefficient on visitor travel is virtually zero. This supports our assumption that it is business travel that matters for international technology transfer, and not other types of air travel.

We have also conducted a number of other robustness checks. First, we have employed the domestic patenting variable (resident and non-resident) lagged by one year so as to reduce the possibility that patent applications in the U.S. simply mirror domestic patent applications. This turns out to yield similar resultst. Second, we have lagged the business traveler variable by one year, exploring the idea that it might take some time until business travel from the U.S. translates into domestic innovation. Also this leads to similar although somewhat lower estimates. Overall this analysis indicates that the estimated impact from U.S. business travel on foreign countries' rates of innovation is robust.

We now turn to a concluding discussion.

5 Conclusions

We have argued that face-to-face meetings might be particularly important for the transfer of technology, because technology is tacit, and therefore best explained and demonstrated in person. Along these lines this paper has examined the impact of inward business travelers in raising a country's rate of innovation at the industry level by looking at business travel from the United States to thirty-six other countries during the years 1993-2003. The results indicate that international business travel has a significant effect. Quantitatively, the impact of business travel on innovation is sizable. It accounts in the typical industry for about 1% of the total difference in patenting rates, and its contribution is about one fifth of the contribution of domestic R&D spending. Moreover, there is strong evidence that the impact on innovation depends on the quality of the technological knowledge carried by each business traveler.

While international migration has long been a hot topic in debates on labor market policies, some recent work has started to address another set of policy questions by linking long-term immigration to innovation in an economy (Peri 2007, Hunt and Gauthier-Loiselle 2010, Stuen, Mobarak, and Maskus 2010). In contrast, our research informs policymakers by examining how strongly short-term cross-border movements affect innovation. In particular, given that entry requirements will tend to reduce a country's number of business travelers, our results provide some initial guidance on the cost of visa or other entry requirements in terms of innovation that can be compared to the benefits entry barriers might have. Our analysis also provides a new perspective on other key policy questions, for example the liberalization of international trade in services. Specifically, the finding that business air travel raises innovation suggests that the liberalization of international passenger air travel, by lowering fares, might yield substantial gains in terms of economic growth across countries. Our analysis also highlights the need for good statistical data on international business travel, a key input for future work on this topic.[21]

While our results suggest that short-term international labor movements could be an important way through which cross-country income differences can be reduced, more work needs to be done. One, it will be interesting to compare our results to studies employing alternative sources of identification, such as policy changes and quasi-natural experiments. Two, an important question is whether the strength of the effect depends strongly on country and sectoral characteristics, as has been shown for technology transfer through trade and FDI (see De Loecker 2007 and Keller and Yeaple 2009, respectively). In our setting, a promising direction of future work may be to include more geographic detail, perhaps isolating key states, such as California. Three, it would be interesting to see whether a country's own outward business travel is affecting innovation as strongly, or even more strongly, as the inward business travel from the United States. Finally, there are important questions regarding the degree of complementarity between cross-border travel, trade, and FDI that future work needs to address.

[21] Fortunately, there are some signs that international agencies are moving into this direction. In particular, the 2008 guidelines of the World Tourism Organization aim at distinguishing business and professional from leisure travelers more clearly; see http://www.unwto.org/statistics/irts/annex.pdf

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6 Appendix

This section gives the details on the sources and construction of our main variables.

Innovation U.S. patent counts: The data on U.S. patents issued from 1993-2003 comes from the United States Patent and Trademark Office (USPTO), Custom Data Extracts. The individual inventor database, which has address information (street, city, state, country of residence, etc) for each of multiple inventors per patent, is combined with the bibliographical patent database, which has application month and year, as well as original USPTO technological category for each patent. If a patent has multiple inventors, we assign a fraction of $1/n$ to each inventors country of residence, where n is the number of inventors. Using the original USPTO technological categories, each patent is assigned to one of 37 subcategories based on NBER patent classification (Hall et al 2001). Then using application month and year for each patent, patents are aggregated by foreign country and technological subcategory for each quarter during the period 1993-2003 to obtain patent counts by foreign countries and industries for each quarter for years 1993-2003.

Joint U.S. patent counts: To identify patents which have a combination of foreign and U.S. coinventors we also calculated foreign patent counts of only patents for which there is at least one U.S. coinventor. Using the same methodology as above, foreign patents with at least one U.S. coinventor are obtained by aggregating by foreign country and industry for each quarter during the period 1993-2003.

U.S. patent stock by states and by industries: For the sample period 1993-2003, each patent with multiple inventors is assigned a fraction of $1/n$, where n is the number of inventors. Then keeping only U.S. inventors, patent counts are aggregated to a given state for each quarter during the years 1993-2003. Similarly, patent counts are aggregated to a given industry for each quarter during the years 1993-2003.

Travel The data on international air travel comes from the Survey of International Air Travelers (SIAT), which is conducted by the United States Office of Travel and Tourism Industries, a branch of the International Trade Administration, U.S. Department of Commerce. SIAT collects data on non-U.S. residents traveling to the U.S. and U.S. residents traveling from the U.S (excluding Canada). This survey has been carried out monthly starting from 1983 on randomly selected flights from the major U.S. international gateway airports for over 70 participating domestic and foreign airlines. Questionnaires in 12 languages are distributed onboard U.S. outbound flight to international destinations.

In this paper we use data on U.S. residents traveling from the United States to foreign countries in the period of 1993-2003. Outbound U.S. resident travel data is an individual level database which has information on travelers' U.S. county of residence, country of citizenship, main purpose of the trip, secondary purposes of the trip, main destination foreign cities, secondary destination foreign cities, occupation, quarter and year of travel. Trips can be made for the purpose of business, visiting friends and relatives, and religious, among others. Possible occupations include homemaker and retired, among others. Main destination and secondary destination cities are both coded. Individual observations are expanded if a particular individual traveled to distinct destination countries, treating each destination as a separate trip. If a particular traveler mentioned multiple purposes of the trip, each purpose is given equal weight. Further, expanded individual travel observations are aggregated by purpose of the trip and occupations by U.S. state and foreign country for each quarter during the years 1993-2003.

Our main variable of interest is B_{scqt}, the number of business travelers from state s to foreign country c in quarter q of year t. We calculated the number of travelers who are visitors, are traveling for religious reasons, or are retired or homemakers in the same way. These aggregated travel variables are weighted by the ratio of U.S. state patent stock to real state GDP and a given industry's strength in the U.S. (source: U.S. department of Commerce, Bureau of Economic Analysis, BEA), see equation (2). The final travel variables are in natural logarithms, with one added to each value. The impact of adding one is small, as the results for the sample with strictly positive numbers of travelers are very similar.

Other variables Population size, real GDP per capita for each year 1993-2003 and country are obtained from Penn World Tables, version 6.2. U.S. exports by country and year 1993-2003 are collected from U.S. Census Bureau (www.usatradeonline.gov). U.S. FDI by destination countries and year 1993-2003 is proxied by the total sales of U.S. majority-owned multinational affiliates and comes from U.S. Bureau of Economic Analysis (BEA). Gross domestic expenditures on R&D expenditures (GERD) for each country in year 1993-2003 are obtained from OECD Statistics, which has data on OECD countries as well as some non-OECD member economies. Each country's total patent applications (by first named inventor) both by residents as well as non-residents of that country in 1993-2003 are from World Intellectual Property Organization (WIPO). All control variables employed in the analysis are in natural logarithms, with the exception of patent applications by residents and non-residents which are in natural logarithms but with one added to each value. The final sample is an unbalanced quarterly sample for 36 countries and 37 industries for the years 1993-2003.

Table 1. Descriptive Statistics

Variable	Mean	Std. Dev.	Min	Max
US Patenting				
US patent counts	26.306	81.471	0	930
Joint US patent counts	0.443	1.541	0	40
US Resident Travel				
Business travel	0.843	0.987	0	7.294
Visitor travel	0.732	0.995	0	7.305
Religious travel	0.021	0.158	0	3.945
Retired travel	0.412	0.762	0	6.355
Homemaker travel	0.214	0.537	0	6.087
Other Variables				
Population	10.230	1.504	5.609	14.068
Real GDP per capita	9.718	0.577	7.599	10.843
US exports	22.745	1.388	18.062	25.436
US FDI	24.069	1.617	16.300	26.734
R&D expenditures	22.684	1.408	18.672	25.385
Patent applications, non-residents	7.824	1.852	0	10.958
Patent applications, residents	8.259	2.197	0	12.859

Note: Number of observations for all variables is 16,992. All variables, except US Patent Counts and Joint US Patent Counts are in natural logarithms. Real GDP per capita, US exports, US FDI and R&D expenditures are in dollars. US FDI is total sales of majority owned multinational firms.

Table 2. Baseline Results

Dependent variable	US patents					Joint US patents
	(1)	(2)	(3)	(4)	(5)	(6)
Business travel	0.056**	0.053**	0.052**	0.050**	0.049**	0.067**
	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.017)
Population		5.300**	4.467**	2.299**	1.980**	0.185
		(0.729)	(0.754)	(0.705)	(0.681)	(1.346)
Real GDP per capita		1.947**	1.050**	0.492	0.417	1.030*
		(0.374)	(0.367)	(0.320)	(0.299)	(0.511)
US exports			0.102	0.015	-0.056	0.737**
			(0.137)	(0.118)	(0.115)	(0.195)
US FDI			0.291**	0.129	0.114	-0.267+
			(0.097)	(0.091)	(0.087)	(0.147)
R&D expenditures				0.872**	0.775**	-0.107
				(0.140)	(0.133)	(0.267)
Patent applications, non-residents					0.079	0.182*
					(0.051)	(0.081)
Patent applications, residents					0.180**	1.001**
					(0.043)	(0.153)
Observations	16,992	16,992	16,992	16,992	16,992	16,992
Log likelihood	-42,068	-41,876	-41,855	-41,810	-41,749	-7,791

Notes: Negative binomial regressions. All specifications include country, year, quarter and industry fixed effects. Robust standard errors allow for clustering by country-year and are shown in parenthesis; + p<0.10, * p<0.05, ** p< 0.01

Table 3: Control Function Regressions					
Dependent variable	Business travel				
	(1)	(2)	(3)	(4)	(5)
Visitor travel	0.738**	0.673**	0.673**	0.624**	0.624**
	(0.006)	(0.009)	(0.009)	(0.010)	(0.010)
Retired travel		0.112**	0.111**	0.093**	0.092**
		(0.011)	(0.011)	(0.011)	(0.011)
Religious travel			0.036		0.021
			(0.028)		(0.029)
Homemaker travel				0.155**	0.155**
				(0.012)	(0.012)
Population	-0.594**	-0.548**	-0.549**	-0.540**	-0.540**
	(0.191)	(0.189)	(0.189)	(0.188)	(0.188)
Real GDP per capita	-0.051	-0.023	-0.024	-0.003	-0.004
	(0.087)	(0.085)	(0.085)	(0.084)	(0.084)
US exports	0.034	0.030	0.030	0.026	0.026
	(0.026)	(0.026)	(0.026)	(0.026)	(0.026)
US FDI	0.016	0.012	0.012	0.008	0.008
	(0.018)	(0.018)	(0.018)	(0.017)	(0.017)
R&D expenditures	0.066*	0.064+	0.064+	0.057+	0.057+
	(0.034)	(0.033)	(0.033)	(0.033)	(0.033)
Patent applications, non-residents	0.007	0.008	0.008	0.009	0.009
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
Patent applications, residents	0.004	0.006	0.006	0.005	0.005
	(0.007)	(0.006)	(0.006)	(0.006)	(0.006)
Observations	16,992	16,992	16,992	16,992	16,992
R-squared	0.833	0.836	0.836	0.839	0.839

Notes: All specifications include country, year, quarter and industry fixed effects. Robust standard errors in parentheses, + p< 0.10, *p<0.05, ** p<0.01

Table 4: Patent Counts with Control Function								
Dependent variable	US patents						US joint patents	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Business travel	0.049** (0.010)	0.029* (0.013)	0.028* (0.013)	0.028* (0.013)	0.028* (0.012)	0.028* (0.012)	0.067** (0.017)	0.060** (0.022)
Population	1.980** (0.681)	2.002** (0.680)	2.006** (0.680)	2.006** (0.680)	2.004** (0.681)	2.004** (0.681)	0.185 (1.346)	0.196 (1.345)
Real GDP per capita	0.417 (0.299)	0.420 (0.299)	0.420 (0.299)	0.420 (0.299)	0.417 (0.299)	0.417 (0.299)	1.030* (0.511)	1.029* (0.512)
US exports	-0.056 (0.115)	-0.059 (0.115)	-0.058 (0.115)	-0.058 (0.115)	-0.058 (0.115)	-0.058 (0.115)	0.737** (0.195)	0.734** (0.195)
US FDI	0.114 (0.087)	0.116 (0.086)	0.116 (0.086)	0.116 (0.086)	0.117 (0.086)	0.117 (0.086)	-0.267+ (0.147)	-0.264+ (0.147)
R&D expenditures	0.775** (0.133)	0.772** (0.133)	0.771** (0.133)	0.771** (0.133)	0.772** (0.133)	0.772** (0.133)	-0.107 (0.267)	-0.107 (0.267)
Patent applications, non-residents	0.079 (0.051)	0.080 (0.051)	0.080 (0.051)	0.080 (0.051)	0.080 (0.051)	0.080 (0.051)	0.182* (0.081)	0.182* (0.081)
Patent applications, residents	0.180** (0.043)	0.179** (0.042)	0.179** (0.042)	0.179** (0.042)	0.179** (0.042)	0.179** (0.042)	1.001** (0.153)	1.001** (0.153)
Control function		0.058* (0.023)	0.063** (0.024)	0.063** (0.024)	0.065** (0.023)	0.065** (0.023)		0.027 (0.038)
Control function type		*Vz*	*Vz, Rt*	*Vz, Rl, Rt*	*Vz, Rt, Hm*	*Vz, Rl, Rt, Hm*		*Vz, Rl, Rt, Hm*
Observations	16,992	16,992	16,992	16,992	16,992	16,992	16,992	16,992
Log-likelihood	-41,749	-41,744	-41,744	-41,743	-41,743	-41,743	-7,791	-7,791

Notes: Negative binomial regressions. All specifications include country, year, quarter and industry fixed effects. Robust standard errors allow for clustering by country-year and are shown in parenthesis; + p<0.10, * p<0.05, ** p< 0.01. Types of travel variables for Control Function (CF): Vz-visitor, Rl-religious, Rt-retired, Hm-homemaker.

Table 5: High versus Low Patenting Industries						
Dependent variable	US patents					
	(1)	(2)	(3)	(4)	(5)	(6)
Business travel	0.049**	-0.099**	-0.111**	0.028*	-0.098**	-0.113**
	(0.010)	(0.014)	(0.015)	(0.012)	(0.016)	(0.017)
Business travel *High patents (median)		0.276**			0.259**	
		(0.021)			(0.021)	
Business travel* High patents (mean)			0.289**			0.274**
			(0.020)			(0.021)
Population	1.980**	2.178**	2.094**	2.004**	2.216**	2.132**
	(0.681)	(0.672)	(0.657)	(0.681)	(0.664)	(0.650)
Real GDP per capita	0.417	0.689*	0.664*	0.417	0.680*	0.657*
	(0.299)	(0.286)	(0.275)	(0.299)	(0.284)	(0.273)
US exports	-0.056	-0.091	-0.100	-0.058	-0.086	-0.096
	(0.115)	(0.105)	(0.099)	(0.115)	(0.104)	(0.098)
US FDI	0.114	0.103	0.106	0.117	0.105	0.108
	(0.087)	(0.081)	(0.079)	(0.086)	(0.081)	(0.079)
R&D expenditures	0.775**	0.721**	0.735**	0.772**	0.711**	0.727**
	(0.133)	(0.124)	(0.120)	(0.133)	(0.123)	(0.119)
Patent applications, non-residents	0.079	0.059	0.059	0.080	0.060	0.060
	(0.051)	(0.042)	(0.042)	(0.051)	(0.042)	(0.042)
Patent applications, residents	0.180**	0.143**	0.140**	0.179**	0.143**	0.140**
	(0.043)	(0.040)	(0.041)	(0.042)	(0.040)	(0.040)
Control function				0.065**	-0.000	0.008
				(0.023)	(0.031)	(0.029)
Control function: interaction					0.094*	0.080*
					(0.037)	(0.035)
Observations	16,992	16,992	16,992	16,992	16,992	16,992
Log-likelihood	-41,749	-41,279	-41,232	-41,743	-41,268	-41,223

Notes: Negative binomial regressions. All specifications include country, year, quarter and industry fixed effects. Robust standard errors allow for clustering by country-year and are shown in parenthesis, + p<0.1, * p<0.05, ** p<0.01. Control Function (CF) in columns (4)-(6) is visitor, religious, retired and homemaker travel.

Table 6: Specification Checks

Dependent variable	US patents			US joint patents		US patents	US joint patents
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Business travel (unweighted)	0.010 (0.009)	0.002 (0.013)	0.000 (0.012)	-0.003 (0.016)	0.001 (0.024)		
Business travel (weighted)						0.087** (0.018)	0.067* (0.030)
Visitor travel (weighted)						-0.043* (0.017)	0.001 (0.030)
Population	1.986** (0.677)	1.992** (0.678)	1.995** (0.678)	0.070 (1.348)	0.067 (1.350)	2.037** (0.680)	0.184 (1.344)
Real GDP per capita	0.413 (0.300)	0.418 (0.299)	0.417 (0.300)	1.005* (0.510)	1.002* (0.509)	0.423 (0.298)	1.030* (0.512)
US exports	-0.069 (0.116)	-0.071 (0.116)	-0.072 (0.116)	0.743** (0.193)	0.745** (0.192)	-0.061 (0.115)	0.737** (0.196)
US FDI	0.118 (0.087)	0.118 (0.087)	0.119 (0.087)	-0.262+ (0.146)	-0.262+ (0.146)	0.115 (0.086)	-0.267+ (0.146)
R&D expenditures	0.784** (0.133)	0.784** (0.133)	0.783** (0.133)	-0.089 (0.266)	-0.089 (0.266)	0.768** (0.133)	-0.107 (0.267)
Patent applications, non-residents	0.079 (0.051)	0.079 (0.051)	0.079 (0.051)	0.186* (0.079)	0.185* (0.079)	0.079 (0.051)	0.182* (0.080)
Patent applications, residents	0.181** (0.043)	0.182** (0.042)	0.182** (0.042)	1.012** (0.153)	1.012** (0.153)	0.179** (0.042)	1.001** (0.153)
Control function		0.017 (0.020)	0.023 (0.020)		-0.010 (0.047)		
Control function type		*Vz*	*Vz, Rl, Rt, Hm*		*Vz, Rl, Rt, Hm*		
Observations	16,992	16,992	16,992	16,992	16,992	16,992	16,992
Log-likelihood	-41,767	-41,767	-41,766	-7,803	-7,803	-41,744	-7,791

Notes: Negative binomial regressions. All specifications include country, year, quarter and industry fixed effects. Robust standard errors allow for clustering by country-year and are shown in parenthesis, + p<0.1, * p<0.05, ** p<0.01. Types of travel variables for Control Function (CF): Vz-visitor, Rl-religious, Rt- retired, Hm- homemaker.

Table A1: NBER Technological Subcategories			
Subcategory	Description	**Subcategory**	Description
11	Chemical: Agriculture, Food &Textiles	**45**	Electrical & Electronics: Power Systems
12	Chemical: Coating	**46**	Electrical & Electronics: Semiconductor Devices
13	Chemical: Gas	**49**	Electrical & Electronics: Miscellaneous
14	Chemical: Organic Compounds	**51**	Mechanical: Mat. Proc & Handling
15	Chemical: Resins	**52**	Mechanical: Metal Working
19	Chemical: Miscellaneous	**53**	Mechanical: Motors & Engines, Parts
21	Computers & Communications: Communications	**54**	Mechanical: Optics
22	Computers & Communications : Computer Hardware & Software	**55**	Mechanical: Transportation
23	Computers & Communications : Computer Peripherals	**59**	Mechanical: Miscellaneous
24	Computers & Communications: Information Storage	**61**	Others: Agriculture, Husbandry &Food
25	Computers & Communications : Electronic business methods and software	**62**	Others: Amusement Devices
31	Drugs & Medicine: Drugs	**63**	Others: Apparel & Textile
32	Drugs & Medicine: Surgery & Med Inst.	**64**	Others: Earth Working & Wells
33	Drugs & Medicine: Genetics	**65**	Others: Furniture & House Fixtures
39	Drugs & Medicine: Miscellaneous	**66**	Others: Heating
41	Electrical & Electronics: Electrical Devices	**67**	Others: Pipes & Joints
42	Electrical & Electronics: Electrical Lighting	**68**	Others: Receptacles
43	Electrical & Electronics: Measuring & Testing	**69**	Others: Miscellaneous
44	Electrical & Electronics: Nuclear & X-rays		

Notes: This classification is based on NBER patent data project classification (classification 2006 excel file). Source: **https://sites.google.com/site/patentdataproject/Home/downloads/patn-data-description**

Table A2A: US patenting by states, 1993-2003			
State	Sum of patents by state, 1993-2003	**State**	Sum of patents by state, 1993-2003
Alabama	4,277	**N. Carolina**	20,142
Alaska	521	**Nebraska**	2,290
Arizona	17,271	**Nevada**	3,692
Arkansas	1,829	**New Hampshire**	6,846
California	202,830	**New Jersey**	41,686
Colorado	21,337	**New Mexico**	3,833
Connecticut	20,141	**New York**	68,699
Delaware	4,668	**North Dakota**	801
Florida	28,949	**Ohio**	35,574
Georgia	15,294	**Oklahoma**	5,893
Hawaii	905	**Oregon**	16,015
Idaho	14,952	**Pennsylvania**	37,766
Illinois	40,205	**Puerto Rico**	258
Indiana	15,905	**Rhode Island**	3,251
Iowa	7,054	**S. Carolina**	6,257
Kansas	4,489	**S. Dakota**	801
Kentucky	4,794	**Tennessee**	8,860
Louisiana	5,083	**Texas**	67,284
Maine	1,585	**Utah**	7,876
Maryland	16,128	**Vermont**	4,209
Massachusetts	40,813	**Virginia**	12,678
Michigan	41,655	**W. Virginia**	1,608
Minnesota	30,280	**Washington**	24,422
Mississippi	1,821	**Washington, DC**	733
Missouri	9,600	**Wisconsin**	19,188
Montana	1,474	**Wyoming**	614

Table A2B: US patenting by industries, 1993-2003		
Subcategory	**Description**	Sum of patents by industries, 1993-2003
11	Chemical: Agriculture, Food &Textiles	2404
12	Chemical: Coating	11,814
13	Chemical: Gas	3,597
14	Chemical: Organic Compounds	15,801
15	Chemical: Resins	22,499
19	Chemical: Miscellaneous	68,308
21	Computers & Communications: Communications	80,433
22	Computers & Communications : Computer Hardware & Software	74,403
23	Computers & Communications : Computer Peripherals	22,983
24	Computers & Communications: Information Storage	34,557
25	Computers & Communications : Electronic business methods and software	16,475
31	Drugs & Medicine: Drugs	67,206
32	Drugs & Medicine: Surgery & Med Inst.	48,587
33	Drugs & Medicine: Genetics	3,927
39	Drugs & Medicine: Miscellaneous	9,298
41	Electrical & Electronics: Electrical Devices	26,673
42	Electrical & Electronics: Electrical Lighting	13,495
43	Electrical & Electronics: Measuring & Testing	25,291
44	Electrical & Electronics: Nuclear & X-rays	11,057
45	Electrical & Electronics: Power Systems	29,589
46	Electrical & Electronics: Semiconductor Devices	40,253
49	Electrical & Electronics: Miscellaneous	18,266
51	Mechanical: Mat. Proc & Handling	30,835
52	Mechanical: Metal Working	16,823
53	Mechanical: Motors & Engines, Parts	19,412
54	Mechanical: Optics	11,005
55	Mechanical: Transportation	24,565
59	Mechanical: Miscellaneous	34,426
61	Others: Agriculture, Husbandry &Food	16,882
62	Others: Amusement Devices	12,920
63	Others: Apparel & Textile	10,156
64	Others: Earth Working & Wells	11,417
65	Others: Furniture & House Fixtures	19,629
66	Others: Heating	6,220
67	Others: Pipes & Joints	5,620
68	Others: Receptacles	15,996
69	Others: Miscellaneous	72,355

Table A3A: Countries in Sample	
Argentina	Luxembourg
Australia	Mexico
Austria	Netherlands
Belgium	New Zealand
China	Norway
Czech Republic	Poland
Denmark	Portugal
Finland	Romania
France	Russia
Germany	Singapore
Greece	Slovakia
Hungary	Slovenia
Iceland	South Africa
Ireland	Spain
Israel	Sweden
Italy	Switzerland
Japan	Turkey
Korea, South	United Kingdom

Table A3B: Countries in Sample		
OECD Countries		**Non-OECD countries**
Australia	Korea, South	Argentina
Austria	Luxembourg	China
Belgium	Mexico	Israel
Czech Republic	Netherlands	Romania
Denmark	New Zealand	Russia
Finland	Norway	Singapore
France	Poland	Slovenia
Germany	Portugal	South Africa
Greece	Slovakia	
Hungary	Spain	
Iceland	Sweden	
Ireland	Switzerland	
Italy	Turkey	
Japan	United Kingdom	