

**The Global Spread of the Internet:
The Role of International Diffusion and Domestic Political Institutions
in Technology Adoption.**

Helen V. Milner
Columbia University
Hvm1@columbia.edu
January 25, 2003

Memo for the conference on new ideas about IR Theory, Duke University, Feb. 21-22, 2003. This paper was initially prepared for the conference on “Interdependence, Diffusion and Sovereignty,” held at Yale University, May 10-11, 2002. I would like to thank the participants at the conference as well as Susan Hanson, John Bargh, Katelyn McKenna, and Rob Trager for their help in facilitating my research on this topic.

INTRODUCTION.

This paper seeks to understand the factors that have promoted and retarded the spread of the internet globally. As a form of technology involving communications, the internet can be seen as an example of the diffusion and adoption of technology generally. As a means for spreading information at very low cost, however, the internet may have a wider impact than some prior forms of communications technology. In part then this project seeks to explain the distribution of the internet across space and time. Much as other technologies, the internet has diffused unevenly across countries. However, its spread has only begun rather recently, largely in the mid-1990s. The main proposition here is that its spread is neither random nor purely economic. Rather political factors exert a powerful influence. Two sets of political factors are explored in detail here. The role of domestic political institutions is of concern. Do these institutions affect policy choices that shape the rate of technological change? Political institutions may matter for the adoption of new technologies because they affect the manner and degree to which winners and losers from the technology can translate their preferences into influence over the policy choices that affect the rate of technological adoption.

In addition, this paper seeks to examine the impact of four different diffusion processes on the global spread of the internet. It asks whether the adoption patterns of other countries have affected the choice of each. Are countries choices of technology and policies affecting it interdependent? Do the policies and practices of dominant global powers, neighbors, competitors or regional hegemony shape the policy choices and technology adoption patterns of a country? Diffusion pressures can take at least four distinct forms. First, the most powerful countries in the world—the so called superpowers or main poles—can affect the policy choices and practices of less powerful states. Traditional international relations theory relies on such pressures. For instance, balance of power theory suggests that weaker states will shape their foreign policies according to the behavior of the main powers. They will choose to balance against those powers near them that threaten them. This theory often suggests that countries will react against the pressures of strong powers in their neighborhood or globally. In contrast, hegemonic stability theory argues that weaker powers will follow the lead of the hegemon. They will adopt similar policies and practices. These two Realist versions of diffusion rely on opposing mechanisms.

Second, diffusion can arise as a result of competitive pressures from a global market, especially one based on capitalism. Such an international market may force countries to adopt policies that foster new technologies or to otherwise try to speed technological change in the quest to maintain competitiveness. The demands of the market then may determine the kinds of policies toward technological change that a country selects. In particular, these pressures may involve the behavior of a country's closest competitors or its more vigorous challengers for market access abroad. Market pressures may force a country to choose the most efficient technology to produce goods and services. Concerns over the "race to the bottom" fall into this category. As we will see, however, most economists nowadays do not believe that this is likely. Too much evidence has revealed too much divergence in the type and rate of technological adoption (i.e., TFPs differ too much across countries) among countries for pure economic pressures to be at work.

Third, countries may engage in a process of rational learning. That is, they might watch and see what types of policies and technologies work in other countries and then select those they feel have demonstrated a proven advantage. This type of learning process should lead to a slow movement over time and across space toward convergent practices. In the long run, most or all countries would end up with similar “best practices,” having emulated other successful countries.

Finally, countries may simply emulate others that are seen as being similar to them. Copying one’s neighbors or those with whom one shares some affinity might be an appealing policy in the face of great uncertainty. Countries with similar historical, linguistic or cultural ties may provide important clues for policy makers in another country about what might work for them. One would expect that the greater the uncertainties surrounding the technology, the greater the temptation to simply copy what other, “similar” countries do. This social emulation process would be distinct from the rational learning process in that one would not expect convergence on “best practices” and one should see inefficient or otherwise undesirable policies adopted.

This paper attempts to sort out the implications of these different diffusion pressures and to see if they have played a central role in the spread of the internet. It also asks whether these global pressures have played a more important role than more domestic ones in shaping policy toward the internet.

LITERATURE REVIEW.

There exists a large literature on diffusion. It covers the diffusion of virtually everything one could think of: technology, ideas, rumors, institutions, disease, cities, plants, language, etc. Diffusion is defined as a process by which some type of innovation “is communicated through certain channels over time among the members of a social system” (Mahajan and Peterson 1985: 7). An innovation is any kind of “idea, object or practice that is perceived as new by members of the social system and can range from a rumor to a rocket ship” (Mahajan and Peterson 1985: 7). The diffusion of innovations from place to place leads to maps that differ from one another (Brown 2001: 3676). Starting from research by Hagerstrand (1952, 1967), it has been shown that all diffusion processes tend to follow a similar pattern over time. The s-shape (logistic curve) growth of adoption of a new idea or process seems well-established (e.g., Morrill et al. 1988: 10; Valente 1995: 3; Brown 2001). From its place of origin, a few innovators begin the process; but then over time a rapid period of adoption occurs as the innovation spreads very quickly. Finally, the process slows as the diffusion becomes complete. Note that this implies that the adoption process is non-linear.

Tables 1 and 2 show that this process is being repeated in the case of the internet. The graph in table 1 shows the growth in the total number of internet hosts in all countries since 1994. But since the net is new, the leveling off phase (i.e., the top of the s) has not been reached yet. The graph in table 2 examines the growth in the total number of internet users; it too shows the s-shaped diffusion process in its early phases. Diffusion appears to be occurring rapidly. The question is to explain how this process is occurring in space and time.

Spatial diffusion requires that agents (animate ones in our case) exist to help effect the transfer of the new process. These agents are often called “change agents” (Mahajan and Peterson 1985: 15). Their ability to diffuse the process depends on the

costs and quality of the paths by which the process moves, the attractiveness of the innovation, and the ability of the place or its inhabitants to absorb the innovation (Morrill et al 1988: 9). For something to be gradually diffused, there must be mechanisms for contacts and persuasion so that the agents can transmit the innovation. Networks of social communication are essential for diffusion (Brown 2001: 3678). It is generally thought that these mechanisms rely on local or neighborhood networks; these so-called “neighborhood effects” are pervasive in the literature (Hagerstrand 1952, 1967; Morrill et. al. 1988: 23-30, 42). Distance thus has a powerful negative impact on adoption, often called “distance decay”. Diffusion thus proceeds in a wave-like fashion, for example from dense urban centers outward in waves to more rural locations. Resistance to the adoption of new processes is also important. Agents differ in their willingness to try new things and make them part of their everyday lives. Some agents are risk-takers and tend to adopt new things first; others are laggards and resist anything new.

Barriers between agents are also an important element of the diffusion process. Such barriers can be geographic, physical, cultural, political, etc. They reduce the level of contacts among agents and make diffusion slower and more costly (Hagerstrand 1952, 1967; Morrill et. al. 1988: 37-41; Brown 2001). Political institutions may be one such form of barriers. Interestingly, Freeman (1985) points out that early adopters of an innovation may be barriers to diffusion themselves. If such early adopters can secure large windfall rents by preventing others from adopting the process, they may seek to use political or economic forces to stop its spread. Similarly, Acemoglu and Robinson (2000: 126) propose the “political loser” hypothesis. They claim that the effect of technological changes on the political power of groups is the key element in predicting whether such innovations will be adopted. For them, those groups whose political power (and not their economic rents) is hurt by technological change will block innovations and their diffusion. If, however, these groups can maintain their political power, then they should not care about the effects of technology on their economic rents since they can always use their political leverage to regain their rents. Their main point is that one should focus on the nature of political institutions and the determinants of political power if one wants to understand the sources of technological backwardness.

In anthropology and political science, diffusion processes have tended to be regarded as methodological problems to be overcome. “Galton’s problem” in cross-national research is the term used for this in political science (Ross and Homer 1976). The problem arises when a correlation is found between two or more characteristics or behaviors of some countries and the attempt is made to attribute this to some internal causal relationship rather than an external diffusion one. It may well be that countries that are alike in certain ways are more likely to borrow from one another, so that this correlation would be generally spurious. Some scholars have called for better sampling procedures so that very diverse states are used in the analysis to mitigate the probability of diffusion. Others, however, have argued for the inclusion of additional variables that capture the influence of diffusion.

As Ross and Homer (1976: 5) claim, “diffusion results from contact among nations, but the specific contact can take a variety of forms. For example, it may involve such diverse principles as imitation, role modeling, reference-group behavior, relative deprivation, status anxiety, learning, rational evaluation of alternatives based on observation, imposition by force, or the power of new ideas. By adding additional

variables representing one or more of the principles to our analysis, we can be explicit about the basis on which diffusion takes place rather than simply considering its presence or absence.” In particular, they suggest adding two variables to any cross-sectional regression on country i that represent the value for the geographically closest country with the same language (call it country j) for the independent variable of interest and the dependent variable:

$$Y_i = \alpha + \beta_1 X_i + \beta_2 X_j + \beta_3 Y_j + \varepsilon_i.$$

Hence β_2 and β_3 are the coefficients representing the (geographical) diffusion processes for country i .¹ Note that Galton’s problem calls into question a fundamental assumption of empirical analysis: it means that the units of analysis are not independent. Hence the number of cases is much less than assumed, and standard tests of statistical significance will return over-optimistic results. Klingeman 1980 made similar claims about the need to model diffusion explicitly, but focused on temporal diffusion. These calls for modeling diffusion processes explicitly, which were made over 20 years ago, seem to have fallen on deaf ears. Clearly, the diffusion of ideas in political science is not a very strong process.

Recently, however, several groups of scholars have revived interest in diffusion pressures in world politics. Mansfield (1998), for instance, claims that as more states enter into preferential trading agreements (PTAs) this increases pressure on other states to form and join PTAs. Kopstein and Reilly (2000) show that spatial diffusion has been an important element explaining the pattern of democratic change in the transition countries in the 1990s. Pressures for democratization grow as one’s neighbors democratize, especially if one is close to the Western European democracies. Cederman (2001) shows that learning seems to be occurring among democracies in their foreign policy choices. Democracies learn when interacting among themselves that peaceful relations are the norm and in time they internalize this behavior. Simmons (2000, 2001) argues that compliance with international norms and regulations toward capital markets has been driven in part by the number of other countries that choose to comply. As more countries adopt a policy, pressures for others to adopt a similar one grow. Interest in diffusion processes seem to be renewed.

Diffusion involves interdependence among the units; the behavior of each is related to the behavior of others. Such interdependence is a central element of strategic interaction in general. Is diffusion simply a subset of such strategic interaction? One question about these processes is whether they are best modeled as ones of strategic interaction where each actor knows (or is making estimates about) the likely behavior of the others or whether these processes rely on systemic dynamics unknown to the actors. If the former is the case, then we have the tools in game theory to be able to model such interactions, even if they are very complex. If the latter is the case, then the type of modeling is quite different. The scholars cited above seem to take different approaches to this question. Mansfield adopts a strategic interaction model that relies on rational behavior. In contrast, Cederman adopts an evolutionary model where a stochastic process generates change over time. This is the familiar choice between focusing on

¹ . They do seem aware that there is likely to be a serious econometric problem here. The independent variable Y_j is likely to be correlated with the error term, introducing bias into the estimation of the coefficients. Thus adding this term may not be such a good idea.

actors and their strategies versus on system dynamics. Unless one can generate empirical tests that differentiate between the predictions of these two types of models, there seem few ways to settle the debate over the best way to conceptualize diffusion.

SOME HYPOTHESES.

What can we learn about the pattern of internet adoption from a study of diffusion pressures? The adoption of the internet in countries is a process of great interest; many have speculated that it will not only change the economy but also political institutions and social relations. The rate at which actors introduce a new technology (its supply) and people in a country being to use the technology (its demand) are greatly affected by the policies that a government chooses for a large range of areas. In the case of the internet, the number of servers linked to the world wide web and the number of users of those servers represent the outcome of such policies, as well as other factors. These outcomes are the best proxies we have for a country's policy toward internet adoption. As in other areas, like international trade, where the policies that affect the issue-area are multidimensional, hard to measure and with uncertain effects on outcomes, the best that one can usually do is to use actual outcomes as proxies for the country's policy choices. Again much as in the area of foreign trade, once one controls for the "natural" components that shape these outcomes, what is left over can be attributed to policy effects. For international trade, one basically uses the gravity model and then assumes that whatever is left unexplained in terms of outcomes (i.e., trade flows) is due to policy. Since we cannot find a measure of all policies that affect the rate of adoption of the internet, the best we can do is use outcomes indicating the rate of server introduction and users as proxies for these policies, once we control for obvious "natural" factors that affect these outcomes.

It is important first to ask about what the rate of internet adoption might be like in the absence of political factors. One might claim that it should follow some purely random process. Many innovations spread stochastically, however (Morrill et al 1988: 13). For example, there is a substantial literature on various topics, including the size distribution of cities in countries, which argues that the distributions of populations and economic activity emerge from a simple stochastic process. One of the key empirical regularity used to describe this is Zipf's law, which holds that the regression of the rank of the log of cities' population sizes against the log of their actual populations will have a slope of -1. Zipf's Law has proved useful as well in explaining the distribution of economic activity and growth (e.g., Gabaix 1999; Davis and Weinstein 2001). If the geographic distribution of the internet follows Zipf's Law, then we would have found evidence that random processes explain some part of its diffusion. Table 3 shows that Zipf's law does not work for internet hosts. The regression of the log of the rank of the number of hosts on the log of the number of hosts is always statistically different from -1; depending on the year, the coefficient ranges from -7 to -17. Internet diffusion does not seem to follow this general stochastic process.

In contrast, diffusion may occur as a result of hierarchical forces (Morrill et. al. 1988:13). Many have noted that spatial diffusion tends to begin in large cities and then spread to less populated, outer-lying areas, or to move from large cities to smaller cities in a hierarchical flow (Morrill et. al. 1988: 47-9). Urbanization levels may thus be an important factor in tracing the spread of innovations. Such hierarchies are important

because the likelihood of interaction among change agents and potential adopters is directly related to the size of the place. More dense populations support more interaction, and hence greater chances for adoption. As economic geographers have claimed, “cities are communications systems” (Abler 1970), and we expect the distribution of the internet to reflect that fact. Moss and Townsend (1998, 2000) show that the existing hierarchy of urban centers in the US (ranked by population, economic wealth, or communications infrastructure) is a primary determinant of the distribution of the internet. The internet does not seem to be challenging this hierarchy, nor leading to the demise of cities and centralization. This finding suggests that pre-existing patterns of both urbanization and global hierarchies should be replicated in the distribution of the internet globally.²

Economic factors might affect the distribution of the internet globally, as they probably do nationally. Evidence exists, for example, that the distribution of the internet follows that of the existing communications infrastructure. This pattern could be the result of two distinct factors: the dependence of the internet upon existing infrastructure (i.e., phone lines for modem access) or the dependence of both upon underlying economic conditions. It may well be that a region’s level of development (i.e., its per capita GDP) provides a critical impetus for the density of communications technologies, for both supply and demand reasons. As has been pointed out, when innovations require specialized infrastructures, their adoption will be channeled to those places that have invested in the infrastructure. Whether these investments have been made often depends on the government in place, and especially on the local political institutions (Morrill et al. 1988: 54-5). Moreover, if models of increasing returns to scale and network effects are correct, then initial advantages should lead to disproportionate growth in the future. If economic factors explain a substantial portion of the distribution of the internet and if initial economic advantages cumulate into growing density over time (i.e., “path dependence”), then this would give support to largely economic explanations of internet diffusion.

Adoption of an innovation tends to be correlated with the potential adopter’s wealth, education, and propensity for risk-taking (Morrill et al. 1988: 52). Given that using the internet requires that its users have a fairly substantial level of education, we expect that a country’s educational level or human capital will affect the decision to adopt it. Countries with higher levels of schooling among their populations should adopt faster and more extensively.

Other than the level of development, various factors such as a country’s size (i.e., its population), its geography (i.e., its distance from major trading partners, whether it’s an island), its culture (i.e., its religion, past (colonial) history, ethnic mix) and linguistic practices (i.e., percent speaking English) may be of importance. Size and geography are obvious influences. The gravity model of trade flows uses them to predict how much countries will trade with each other. They also seem important influences on the decision to adopt a new technology. Bigger countries may be slower to adopt, *ceteris paribus*. However, if distance raises transport and communications costs, then a technology like

² . In terms of the impact of the internet, there is great debate over whether it will lead to radical change of hierarchies or simply reinforce existing ones. Most sensibly, Tyler (2002: 201-2) notes that “the social consequences of technology depend upon the social context in which the technology is utilized....Whether the Internet is, in fact, a social-leveling technology depends not upon the technology itself, but upon the political and social framework within which it is implemented.”

the internet may be especially useful (cost-effective) in a larger country. Traditionally, it is expected that countries that are more distant or isolated from others should be less likely to adopt. This may not be the case for the internet if the costs of distance again trump the value of increased interaction. If social emulation across countries depends on similarities in culture and language, then these factors should also play a large role in explaining its spread across countries. All of these factors tend to be relatively constant over time; hence they cannot well explain a country's adoption patterns over time (i.e., the longitudinal element of change within a country). But they may do a good job of explaining broad cross-national patterns of adoption.

Economic competition among countries (or perhaps even political competition) might explain adoption patterns as well. The global market may create very substantial diffusion pressures, encouraging political actors to tailor policy in ways to encourage its adoption. The internet may provide important economic advantages. Scholars (e.g., Freund and Weinhold 2000) have shown that it increases trade flows, largely by reducing information and transaction costs. It may generate significant political advantages relative to other countries as well. For these reasons, countries may be forced by competitive pressures to imitate their neighbors or rivals and adopt this technology. If so, diffusion should be driven by other countries' adoption patterns. Do other countries' rates of adoption affect a country's own rate? In particular, we might anticipate that regional neighbors would exert a powerful effect on the adoption patterns of states within their regions (i.e., "neighborhood effects"). As other countries adopt the internet, does that make a country more likely to do so? More specifically, as other countries in a country's own region adopt, does that make the country more likely to? It may also be the case that a country's adoption patterns follow those of its economic rivals closely; do, for instance, the rates of adoption of a country's leading trading partners affect its own rate? Catching up with or staying even with one's neighbors and rivals may be a political and economic imperative for countries.

Do political factors matter for the diffusion of the internet globally? Is there reason to believe that, even after controlling for the above factors, political influences might explain the distribution of internet activity? I consider two types of political influences: international and domestic ones. On the international side, since information is now clearly an element of national power, all governments should be interested in acquiring greater capacity to obtain information. Cost aside, countries may be differentially motivated. It may be that the adoption of new technology elsewhere depends on the diffusion of that technology or related ones from the leading innovator or world power. The US is clearly the leading adopter and innovator of internet technology. Thus we should see that the more hegemonic the country is, the more others follow its lead. Hence rising US hegemony—in terms of the internet particularly and in general—should make others follow the US adoption pattern more. Slightly differently, we might see that those countries with interests more in common with the US should adopt internet technology more quickly. On the other hand, fears of US "cultural imperialism" may lead countries to restrict their access. As some have noted, "The United States, as the origin and embodiment of much of Western mass culture, is the enemy of those who view increased contact and information flows as threats to local culture and mores. American dominance of Internet traffic and the Worldwide Web, now decreasing but still

predominant, is viewed as ‘evidence’ that the United States is using the Internet to promulgate its opinions, culture, and way of life” (Goodman et. al. 1998: 246).

In addition, a learning hypothesis might suggest that country’s policies toward the internet might be affected by what they know other countries to be doing. How do countries learn from one another? Some posit simple interaction over time that builds confidence (e.g., Cederman 2000), but it might be that countries learn faster or are more likely to learn the more they interact with others. Being in various international organizations might affect this. Both the number of international organizations a country is a member of and in particular membership of certain organizations might be important. Being a member of the GATT or WTO might be especially important for it is an organization that provides countries with information about the trade practices of others.

A second set of political factors involves those at the domestic level. As with the adoption of any technology, its success is likely to depend on the underlying political order. The laws, regulations, subsidies, and taxes that governments choose to employ or not may substantially affect whether actors invest in the new technology, as North (1990) among others has argued. Political and economic groups that lose politically from the spread of the internet may also try to retard its diffusion (e.g., Mokry 1990; Acemoglu and Robinson 2000). They may seek to use the country’s political institutions to enact policies that do this. Some institutions may be more susceptible to such purposes than others.

Government policies can have a major impact on the adoption and use of new technologies, and the internet is no exception to this. As Goodman et. al. (1998: 12) argue, “the most important determinant [of the spread of the internet is] government policy [which] belongs in a category by itself, since the policies of government overlay all other determinants, affecting both their nature and their effectiveness, based upon a government’s ability to exercise coercive power. The policies created by a government are generally intended to achieve the fulfillment of that government’s goals, which may be more or less closely related to the goals of those governed, depending upon the form of government.” Government policy toward the telecommunications sector generally can greatly affect the internet’s spread in a country. Policies regarding government control over and intervention in telecommunications, including a myriad of issues such as licensing, taxation, subsidization, investment of foreign capital, access restrictions, infrastructure investment, and standards setting in this sector, are of particular importance. Different governments will make different choices about these policies, and in doing so will affect the rate of internet adoption.

Do domestic political institutions make a difference for these policy choices? First, it seems likely that countries that are more democratic will be more supportive of the growth of the internet. The extent of civil liberties may also matter; more freedom of the press, association, religion, etc. may all encourage the development of internet activity. Certainly, we would expect that autocratic regimes and ones where civil liberties are restricted would not create environments that facilitated the growth of the internet.³ Autocratic governments should want and be better able than democratic ones to

³ . According to Freedom House reports (Susman 2000:7), the countries which exert very significant control over Internet access are Azerbaijan, Belarus, Burma, China, Cuba, Iran, Iraq, Kazakhstan, Kyrgyzstan, Libya, North Korea, Saudi Arabia, Sierra Leone, Sudan, Syria, Tajikistan, Tunisia, Turkmenistan, Uzbekistan, and Vietnam. Note that these are all autocratic.

prevent the spread of the internet. They should be able to determine the supply of the internet and other communications infrastructure. As Goodman et. al. (1998: 23-4) claim, “To the extent that it provides an additional communications medium, the Internet can be seen as a threat to coercive control, whether internal or external. In its most basic form, it is merely another means of sharing information. However, the robust nature of the international network and the fact that it is a store-and-forward medium (asynchronous) presents unique problems to [national] security services. To date, the principal use of the Internet in relation to internal security has been either from outside to encourage civil disobedience and even revolt inside, such as the activities of the London-based Council for the Defense of Legitimate Rights (CDLR) against the Saudi Arabian monarchy, or from inside to rally international support for a cause, as in the case of the Zapatista insurgency in Mexico. Although there may be the potential for the Internet to be used as the base for computer-based attacks by dissidents or revolutionaries (or criminals) against a government, even the use of the Internet as a propaganda medium, to the extent that it by-passes the state’s information control apparatus, is viewed as a significant security threat by many internal security services.”

This suggests that autocratic governments will desire to regulate the internet closely and perhaps restrict its diffusion, if not just its content. As one report on internet freedom notes, “By a French monitoring organization’s estimate, 45 countries now restrict Internet access on the pretext of protecting the public from subversive ideas or violation of national security—code words used by censors since the sixteenth century” (Sussman 2000: 1). However, it may be that since other forms of communication and expression are tightly controlled in countries with autocratic regimes, the demand for the internet is even greater than elsewhere. China may be an example of this phenomenon. Demand pressures and supply ones may move in opposite directions depending on a country’s regime type.

Figuring out the main political and economic winners and losers from the growth of the internet is an important first step in understanding the politics of the net. As one assessment of its global diffusion points out (Goodman et. al. 1998: 243), “while national wealth is a major factor in Internet development within a country, perhaps more important is the issue of constituents, or stakeholders, for and against the acceptance of the Internet. The adverse effects of ‘negative stakeholders’ can be seen clearly in the case of Saudi Arabia, which can afford the technology financially, but where a preponderance of stakeholders believe that the country cannot morally or politically ‘afford’ the Internet without significant controls and constraints. On the other hand are countries like Finland and Yemen, where there are constituents for the Internet but no significant opposition. In Finland, the ‘pull’ is strong and the country’s relative wealth supported early, extensive development. Yemen appears at first to be an anomaly, because of its poverty, but there again at least the supporters of the Internet could afford the investment, so in the absence of opposition a basic capability was developed.”

Some have already claimed that evidence shows that autocratic governments are more opposed to and restrictive of the internet. Goodman et. al. (1998:243) conclude from their study of 13 countries that “It appears clear at this point in the studies that government policy plays a key role in the diffusion of the Internet. A general rule that has emerged is that stronger centralized control results in slower Internet development and less proliferation. This is likely due to the fact that the strength of government control is

somewhat inversely proportional to popular participation in and support of the government. That is, the more coercive the government, the more it has to lose from easing controls; it is caught in a self-reinforcing cycle whereby strong controls are necessitated by lack of popular support and a lack of popular support is due in large part to oppressive government controls.” To my knowledge no large scale quantitative tests have been performed on this hypothesis, and this is what I intend to do. Are democratic countries more likely to foster the adoption of the internet than more autocratic ones, *ceteris paribus*?

Political institutions may matter for explaining the adoption of the internet, but so will the level of violent conflict a country is experiencing. Countries involved in wars, whether international or civil, should be less likely to adopt since they are likely to have both their capital spending and investment and their attention diverted to winning the war and not adopting new civilian technology. On the other hand, one might expect external conflict to lead to greater pressure for innovation so that a country can build its capabilities. This suggests that the demand for new technology might be higher in periods of conflict, but that the supply might be lower given financial constraints. In general, we expect the greater the involvement in war and/or the greater the number of casualties from any type of war in a country, the slower the rate of adoption of the internet.

SOME IMPLICATIONS FOR IR THEORY:

Do diffusion processes make us think differently about international politics? Certainly the realist propositions that powerful actors can shape other countries’ behavior does not seem very new. The notion, however, that countries may react against a hegemonic power, which receives some support in our data, contradict hegemonic stability theory. It may be that in line with balance of power claims, countries try to shield themselves from the full force of a hegemon and resist pressures to follow in its footsteps. Hegemony may suppress diffusion of practices from the hegemon.

The pressure generated by markets are less central to most of IR. The recent globalization literature has picked up on this to some extent, however. The claim is often made that global markets (e.g., bond markets, portfolio investors, etc.) may exercise great power over political leaders, forcing them to change policies and adopt more market friendly ways. Certainly, these pressures do not seem able to overpower the impact of domestic politics. Authoritarian governments seem able to choose policies that suppress the spread of the internet and so far they do not seem to have suffered much at home. Market pressures may be more powerful now than before widespread capital mobility existed, but as Garrett and others have stressed domestic political institutions can still shape how these pressures are felt and allow political actors extensive leeway to choose policies.

Learning is more novel to IR theory. Do states watch and learn from the mistakes and successes of other countries? Do governments import practices that they learned from other countries or from international organizations? Our initial evidence is not

supportive of this. Membership in GATT/WTO had little positive impact on inducing countries to choose practices that fostered the adoption of the internet. We have not modeled learning very well here. Certainly the data show that over time countries are rapidly adopting the internet, and perhaps this is rational learning.

Emulation, our fourth form of diffusion, is even harder to explore. We need better ideas about who countries seek to emulate and under what conditions they are most likely to do so. Is it neighbors that they copy? Countries that seem like themselves in terms of culture, or economic development or language? Emulation is quite a novel idea for IR. Simply copying other states in their policy choices, no matter whether they are successful or not, is an idea few in IR explore. In periods of great uncertainty or change, this behavior may be more common as governments cast about for new ways to adapt.

The contest between these types of international pressures and domestic ones seems to be one-sided. Domestic political institutions and economic factors seem to play a far more important and consistent role in shaping choices over technology adoption than do these international factors. Perhaps diffusion pressures from abroad are simply filtered through the domestic environment by political leaders. In any case, we think domestic factors still account for far more of the variance in internet adoption across countries and time than do international ones.

Bibliography

- Abler, Ronald. 1970. "What Makes Cities Important." Bell Telephone Magazine.
- ACLP. (See Przeworski et. al. below)
- Acemoglu, Daron and James Robinson. 2000. "Political Losers as Barriers to Economic Development." American Economic Review: Papers and Proceedings. 90 (2): 126-30.
- Barro, Robert and Jong-Wha Lee. 2001. "International Data on Educational Attainment: Updates and Implications." Center for International Development Working Paper # 42.
- Beck, Nathaniel and Jonathan Katz. 1995. "What to do (and not to do) With Time-Series-Cross – Section Data in Comparative Politics." American Political Science Review. 89 (3): 634-47.
- Beck, Nathaniel and Katz Jonathan. 1996. "Nuisance vs. Substance: Specifying and Estimating Time-series-cross-section Models." Political Analysis. 6:1–36.
- Brown, Larry. 2001. "Diffusion: Geographical Aspects." International Encyclopedia of Social and Behavioral Sciences. Pp.3676-81.
- Cederman, Lars-Erik. 2001. Back to Kant: Reinterpreting the Democratic Peace as a Macrohistorical Learning Process. American Political Science Review 95 (1):15-31.
- Database on Political Indicators (DPI). 2000. World Bank.
- Davis, Donald and David Weinstein. 2001. "Bones, Bombs and Break Points: The Geography of Economic Activity." NBER Working Paper #8517.
- Deibert, Ronald. 2002. "Dark Guests and Great Firewalls: The Internet and Chinese Security Policy." In McKenna and Bargh, eds. "Consequences of the Internet for Self and Society," special issue, Journal of Social Issues. 58 (1): 143-160.
- Easterly, William and Ross Levine. 1997. "Africa's Growth Tragedy: Policies and Ethnic Divisions." Quarterly Journal of Economics 112 (November): 1203-50.

- Freeman, D. 1985. "The Importance of Being First." Annals of Association of American Geographers. 75: 17-28.
- Freund, Caroline and Diana Weinhold. 2000. "On the Effect of the Internet on International Trade." Board of Governors of the Federal Reserve System. International Finance Discussion Papers. Number 693. December.
- Gabaix, Xavier. 1999. "Zipf's Law for Cities." Quarterly Journal of Economics. 114, #3, 739-67.
- Goodman, Seymour E., Grey E. Burkhart, William A. Foster, Laurence I. Press, Zixiang (Alex) Tan, Jonathan Woodard. 1998. The Global Diffusion of the Internet Project: An Initial Inductive Study. The MOSAIC Group:
<http://mosaic.unomaha.edu/GDI1998/0CONTENT.PDF>.
- Hagerstrand, Torsten. 1952. The Propagation of Innovation Waves. Lund, Sweden: Lund Studies in Geography.
- Hagerstrand, Torsten. 1967. Innovation Diffusion as a Spatial Process. Chicago: University of Chicago Press.
- Henisz, Witold J., (2000) "The Institutional Environment for Economic Growth", Economics & Politics, 12(1):1-31.
- Klingeman, David. 1980. "Temporal and Spatial Diffusion in the Comparative Analysis of Social Change." American Political Science Review. 74 (1): 123-37.
- Kopstein, Jeffrey, and David Reilly. 2000. Geographic Diffusion and the Transformation of the Postcommunist World. World Politics 53 (1):1-37.
- Mahajan, Vijay and Robert Peterson. 1985. Models for Innovation Diffusion. Newbury Park, CA; Sage Publications.
- Mansfield, Edward D. 1998. The Proliferation of Preferential Trading Arrangements. Journal of Conflict Resolution 42 (5):523-43.
- Marshall, Monty and Jagers, Keith. 2001. "Polity IV." Integrated Network for Societal Conflict Research (INSCR) Program, Center International Development and Conflict Management (CIDCM), University of Maryland, www.bsos.umd.edu/cidcm/inscr/polity, December 1, 2001, Version 2000.
- Morrill, Richard, Gary Gaile, and Grant Thrall. 1988. Spatial Diffusion. Newbury Park, CA: Sage Publications.
- Moss, Mitchell and Anthony Townsend. 1998. "Spatial Analysis of the Internet in US Cities and States." Paper prepared for the conference on "Technological Futures", Durham, England, April 1998.
- Moss, Mitchell and Anthony Townsend. 2000. "The Role of the Real City in Cyberspace." In D. Janelle and D. Hodge, eds., Information, Place, and Cyberspace Issues in Accessibility. Berlin: Springer, 171-86.
- North, Douglass. 1990. Institutions, Institutional Change and Economic Performance. Cambridge: Cambridge University Press.
- Przeworski, Adam, Mike Alvarez, Jose Cheibub and Limongi. 2000. Democracy and Development: Political Regimes and Material Well Being in the World. New York: Cambridge University. Updated data to 2000 available from Cheibub.
- Ross, Marc and Elizabeth Homer. 1976. "Galton's Problem in Cross-National Research." World Politics. 29 (1): 1-28.
- Simmons, Beth. 2001. The International Politics of Harmonization: The Case of Capital Market Regulation. International Organization 55 (3):589-620.

- Simmons, Beth. 2000. International Law and State Behavior: Commitment and Compliance in International Monetary Affairs. *American Political Science Review* 94 (4):819-36.
- Summers, Robert, and Alan Heston. 1991. "The Penn World Table (Mark 5): An Expanded Set of International Comparisons." *Quarterly Journal of Economics* 106:327-68. Version 6.0 is updated to 2000: <http://webhost.bridgew.edu/baten/>.
- Sussman, Leonard. 2000. "The Internet and Press Freedom 2000." Freedom House. <http://www.freedomhouse.org/pfs2000/sussman.html>.
- Tsebelis, George. 1995. "Decision Making in Political Systems: Veto Players in Presidentialism, Parliamentarianism, Multicameralism, and Multipartyism." *British Journal of Political Science*. 25: 289-325.
- Tyler, Tom. 2002. "Is the Internet Changing Social Life?" In McKenna and Bargh, eds. "Consequences of the Internet for Self and Society," special issue, *Journal of Social Issues*. 58 (1): 195-205.
- World Bank. (WB WDI). 2001. *World Development Indicators*. Washington, DC: World Bank. CD-ROM.

Table 1: The Diffusion of the Internet: Global Hosts

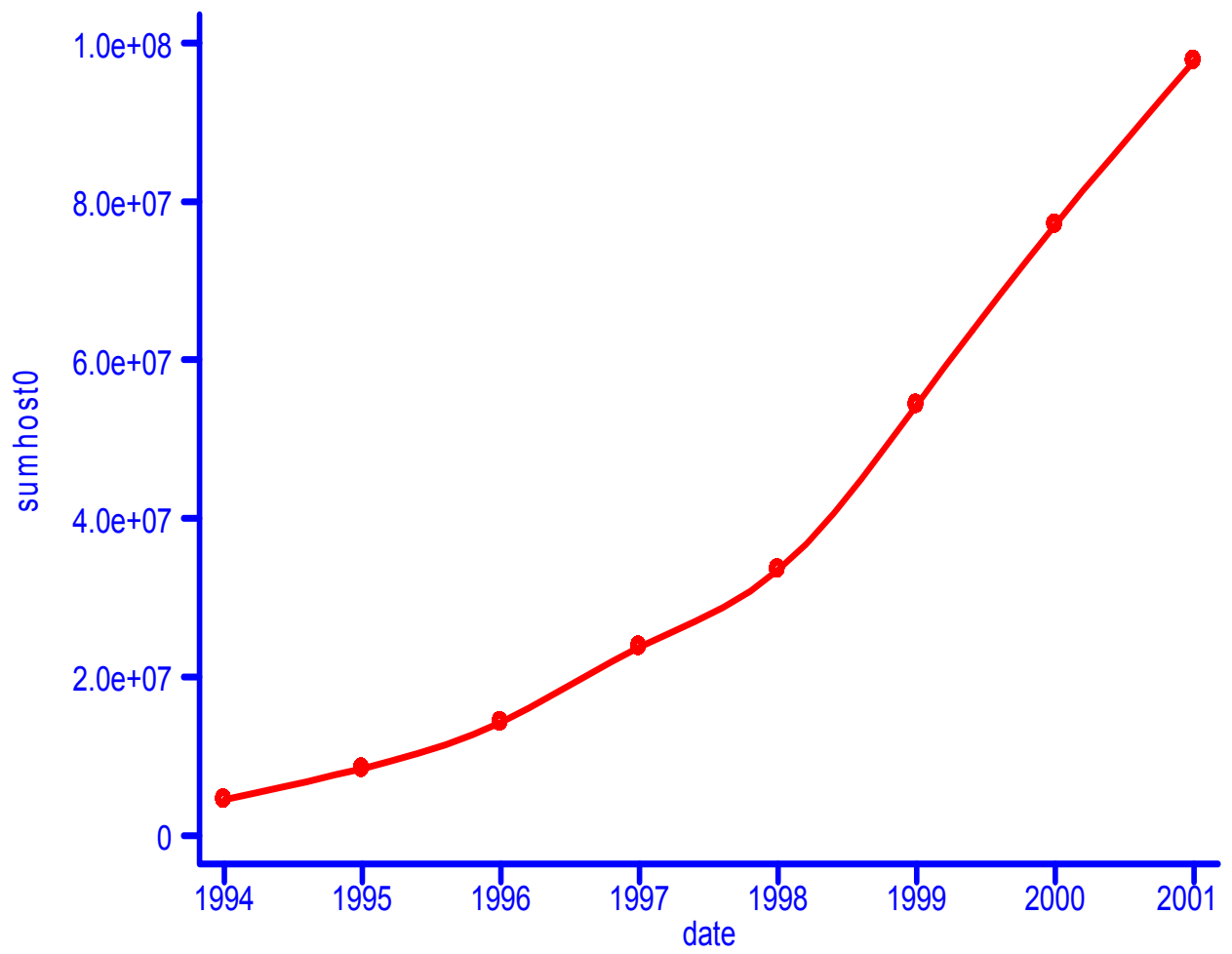


Table 2: The Diffusion of the Internet, Global Users

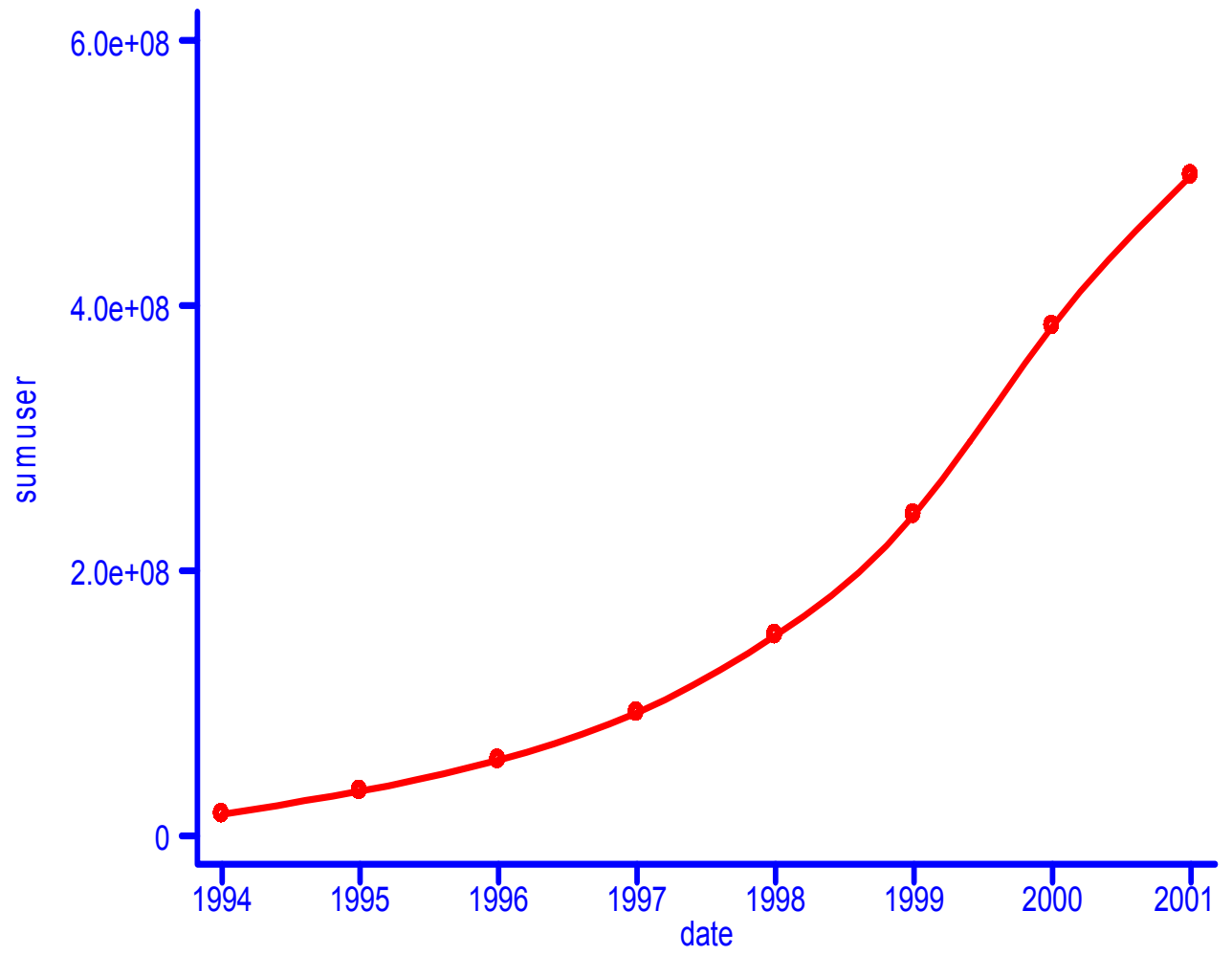


Table 3: No Random Diffusion of Internet Hosts, 1998

