Helping or Distracting? Information Technology's Offer to Productivity

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Econometrics

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Introduction

From the moment of its emergence, information technology has become an important part of our lives. With computer and internet, we can study online courses from MIT; talk to our family using webcam as if we are just face to face; email people who are thousands of miles away… We can say without exaggeration that they changed our way of living in every possible way.

The Weather forecast you watch everyday cannot be as what it is without the support of IT technology on satellite and rockets. The car you drive is designed using computer programs, and put together by automatic assembly lines that are controlled by computers. The way people do business today also improved so much thanks to IT technology. In the book "The world is flat" by Thomas Friedman, he mentioned that in the headquarters in Bangalore, they have a conference room with a whole wall of displays connected to other head quarters around the world. With the help of IT technology, multinational companies accelerated their pace of outsourcing and world dominance. Today, many companies' night telephone services are done by people living thousands of miles away in India. Not just those, even some tax returns in US are done by Indian accountants as well. The digitalization revolution allows people all over the world to work together. Internet has become the biggest and most efficient platform for exchanging knowledge. By using internet, library is no longer the ideal place for learning. On the internet we can access millions of works done by others and the knowledge is updating at each second. This also enables many researches that seems impossible in the past. Take this paper as an example, to collect data for my research, I don't need to go around the world and record every countrie's data one by one. Instead, I go to online data sources and everything is there. This giant system also prevented people from repeated works. With more knowledge about where the cutting edge is in various studies, people can start from the point of the very front, continue from others' work. Internet and computers also make communication faster and cheaper, which also promoted large scale community and organization to form and develop.

Literature Review

Someone might wonder, after all these innovations, what and how much have we gained from them. The whole world invested millions of dollars every year on IT equipments. From table 1 we can clearly see the surge increase in investment in the 90's. (Dewan and Kenneth L. Kraemer, page2) However, the productivity statics responded to this growth in investment reluctantly. There we came to the question of productivity paradox of information technology, or the Solow paradox. The origin, as what Erik Brynjolfsson stated, is that "delivered computing-power in the US economy has increased by more than two orders of magnitude since 1970 yet productivity, especially in the service sector, seems to have stagnated". (Brynjolfsson) Although people have done a lot of researches on this topic, the real relationship between IT and the improvement in productivity is still unclear, which also makes this topic especially interesting to me.

There are two major streams of researches on this topic. In the 90s works done by Oliner, Sichel, Whelan and Jorgenson suggest that the use of information technology made a substantially larger contribution to output growth in the late 90s in USA. In

Oliner and Sichel's study of US labor productivity in the 90s they conclude: "We attribute 0.45 percentage point of the pick-up (in acceleration of labor productivity) to the growing use of information technology capital throughout nonfarm business sector. The rapid improving technology for producing computers contributes another 0.25 percentage point …We estimate that the information technology accounted for about two-thirds of the step-up in labor productivity growth between the first and second halves of the decade." (Oliner and Sichel) And in their later work which looked at the same topic but with data through 2001, they reconfirmed their conclusion: "new growth-accounting results indicate that … output per hour accelerated substantially after 1995, driven in large part by greater use of IT capital goods by businesses throughout the economy and by more rapid efficiency gains in the production of IT goods." Their data in the paper shows that until 2001, 63% of the acceleration in labor productivity was contributed by information technology capital. Eric Brynjolfsson and Lorin M. Hitt's research also focused on firm level data. They conclude that the investment in IT technology increases a firm's marginal output as well as the consumer surplus, but the effect on business profitability tends to be slim.

However, critiques say that their finding of a positive relationship between IT and productivity was only based on the firm level data, and a limited time period. In response, Dewan and Kenneth published a paper published in 2000 in which they looked at economy-level data and find positive relationship between compensation of IT capital per worker and change in GDP per worker. The result shows that the magnitude of marginal return is higher in the developed countries compare to developing countries. Their explanation is that "there is ample room for productive IT investment to take advantage of substantial returns at the margin … compare to the advanced economies, less-developed countries have poorer infrastructure, inherently less productive human capital and business models that have yet to transition from the industrial to the information age."

In comparison, not everyone found the same result. In 1997, Catherine Morrison wrote: "a common perception is that this dramatic increase in office and information technology equipment has not had a commensurate impact on firms' cost and productivity." Also, Baily and Gordon described: "…official data show enormous productivity gain in the manufacture of computers, but apparently little productivity improvement in their use." (Baily and Gordon 1988 pp 350-351) Many other researches even show that there is a significantly negative relationship between IT usage and productivity. Michael Kiley estimates that the growth contribution from computer hardware has been negative since the mid-1970s in USA. As what Robert Solow put it: "you can see computers age everywhere but in the productivity statistics." So who is right? Did we really gain nothing in productivity from the massive use of information technology? Are all the improvements in efficiency just our illusion?

Data

In this paper I chose to use a panel data intended to get more information, more variability, more degree of freedom and more efficiency. My goal is to examine the effect of information technology usage on productivity. Unfortunately, the massive use of information technology among public is only a story of recent 20-30 years. The data of number of users of computer or internet are only available from 1990. The data I collected are mostly from two sites: the UN data and International Labor Organization (ILO). Together they cover 118 countries with various time lengths. For some countries the data set covers all the way from 1980 to 2008, the majority of countries have data available from 1990 to 2007.

The main variables I used in my research are GDP per person engaged, number of computer uses among 100 people, number of internet users among 100 people, GDP per capita and trade volume. Ideally, a universal standard index of all countries' productivity would be the best. However, very limited amount of countries have thisdata. On the internet it is only available for OECD and APEC countries, which wouldn't give me enough variance and dynamics. Moreover, the database only covers a short period, which could create problems if I want to look at the effect of IT over a long period of time. But avoiding direct use of productivity might not necessarily be a bad thing. Productivity is something hard to quantify, especially when it comes to industries such as service industry where the measurement error can be substantial. Plus, it would be even harder to do cross country measurement. So instead, I used the data set from ILO, which offers data of GDP per person engaged (constant 1990 us$ at PPP). There is also GDP per hour worked in their data set, but compare to 1889 data points in the first one, 871 observations in the second one is not as sufficient. Moreover, since this panel data covers a lot of countries with different kinds of currencies, the use of Purchasing Power Parity (PPP) take the relative cost of living in to account, which gives us a more valid GDP comparison between countries.

My other variables such as number of computer uses among 100 people and number of internet users among 100 people are from UN data.(I will call them "internet usage" and "computer usage" later for convenience purposes.) We can see from the data that there is a clear upward trend in both computer users and internet users per 100 people over time. (Figure 1and 2) besides the increase in mean, the variance also increased a lot. As for the underlying reason, some countries just got started on the stock of IT equipments while others have been investing in IT for years. Thus we can still see really low points even in the recent years. I didn't use GDP per capita directly as a control variable in the beginning, but as you will see later, it will make a lot of difference after dividing the countries into groups based on their GDP per capita.

In conclusion, by covering all countries where internet user number data are available, this data set can represent not only the difference between different countries, but also the change in every country over time.

Econometrics Model

In this paper, I established an econometric model represented by the following equation:

$$gdpperworker = \beta_0 + \beta_1 lninternetper100 + \beta_2 lnpcper100 + \beta_3 lntradevol + u$$

Where gdpperworker stands for GDP per person engaged; lninternetper100 stands for logged number of internet users per 100 people; lnpcper100 stands for logged number of computer uses among 100 people and lntradevol stands for logged trading volume.

The rational of the function form is that, the increase in number of internet users will increase the productivity of a worker, but the return to scale is not constant. Up to certain point, the increase in internet accessibility will not be able to further promote the worker's productivity. The number of computer uses among 100 people will also be a big factor. Since this is a main indicator of how easy can a person access computer, which be the terminal of the internet. The more computer users there are the easier people can get on internet. But just like internet, once there are enough computers in the market, the additional computers won't give you the same marginal return.

Also, international trade could contribute a lot in improving labor productivity. Take China as an example, the opening up policy brought China a huge amount of FDI. Along with the bills coming into China, there are new technologies, new managing ideas, etc, which make the production process in China much more efficient than before. However, the importing of new technologies is also a one-time transaction. After the importing process is done, the trading volume can grow just because of lager scale of production, not necessarily higher productivity. Thus it makes more sense to use log form.

Results and Analysis

Doing a simple scatter plot, (Figure 3, 4and 5) we can see clear upward trends in the data, which suggest that logged internet and computer usage, as well as logged trading volume, have positive impacts on GDP per worker. However, the real result from regression report is very surprisingly different. The result of all regressions is reported in table 3.

To start with, I ran OLS regressions on the pooled data. In the simple regressions I found that number of internet users per 100 people has a positive impact on GDP per person engaged. The coefficient is 3056 with t stats of 27.85, which shows that the result is significant. Same positive impact was also discovered in the simple regression of computer users per 100 people on GDP per person engaged. Here I got 7267 in the coefficient and 51.68 for t stats, and notably, both R-square and adjusted R-square are near 0.69, which is very high. This tells us that in all countries over the years, if we just look at the relationship between the usage of computer or internet along and the corresponding GDP per worker, there is a clear positive trend, this matches what we've found in the visual tests. However, when I ran the multiple-regression, in which I assumes the model:

$$gdpperworker= \beta_0 + \beta_1 lninternetper100 + \beta_2 lnpcper100 + \beta_3 lntradevol + u$$

Surprisingly it turns out that internet has a significantly negative impact on GDP per person engaged, while computer usage and trading volume remain significantly positive. My understanding of this is controlling for number of computers and trading volume the more internet access people have the less productive they are. Why is this? When thinking into it, it's actually not that incomprehensible. Suppose each person in a country has certain amount of computers on average, further suppose that they need internet for completing their work, then we know that after completing the same amount of work, the more hours they spend on internet, the less "productive" they are during work. The case becomes especially typical when the completing the work relies on the access to internet but not entirely based on internet support. Then after it functioned as a great resource for working, it could become a "black hole" to distract people from their works. Thus a negative relationship between internet accessibility and GDP per person engaged is not that impenetrable. Also, it is possible that within each country there is a downward effect of internet on GDP per person engaged, but since there are countries that have high IT usage and high GDP per person engaged and countries where both IT usage and GDP per person engaged are low, the overall relationship looks as if it's upward sloping.

Someone might question, is it appropriate to compare all countries together? Will it make more sense to look at the case in each country? It is possible that the relationship between IT usage and GDP per person engaged is different from country to country, in that case it's more reasonable to analyze one country at a time and look at the change within each country. So I went on and ran fixed effect on the original regression. In panel data, there are three kinds of error terms, one is time invariant, one varies over time, and the last one varies across sections and over time. In fixed effect, it is assumed that the time invariant error term is fixed for each country. This means in fixed effect, each country will have a unique intercept with Y. In fixed effect, it is also assumed that all countries have the same slope. In other words, the unit effect of one percent change in logged internet or computer is the same for every country. Fixed effect will calculate the mean of X and Y for each country, then fit lines with same slope into each country.The result is reported in table 3(regfe). From the table we can see that internet usage was not as negative as what it was. In fact, it is close to dropping out from 5 percent significance. Also, the coefficient of computer usage dropped a lot compare to the multiple regression, but still significantly positive. This means within every country, assuming that the use of internet and computer would have the same effect on every country's growth over time the effect of internet accessibility has a slightly negative impact on GDP per person engaged, the effect of internet accessibility is slightly negative on GDP per person engaged while computers always have a strongly positive impact. In comparison, I also ran the random effect test. In random effect, the non classical errors are transformed into classical error terms, so the coefficient estimates are efficient. The results of this are reported inTable 3, regre. We can see that computers still holds a strongly positive effect on GDP per person engaged, but the internet again shows a strongly negative impact just as in the multiple regression.

To see which one is more valid, I carried out the Hausman test. My p value is 0 in Hausman test, which means that fixed effect's result is preferred to random effect in this case.

Furthermore, There could be a problem with non- stationarity. We know that in general, there are upward trends in both GDP and IT usage. If it's the case that since both of them are going up over time, the regression between these two will still looks like as if they are correlated, even if they change for different reasons. To see if it's just because of the time trend, I added the time variable in. from Table 3 regt we can see that the coefficient for internet accessibility dropped out of significance. However the effect of computers remains strongly positive. This tells us, controlling for time, the effect of internet on GDP per person engaged is insignificant. However, the effect of computers is always positive.

So far we have observed that in many cases, number of computer users per 100 people always has a positive effect on GDP per person engaged. On the other hand, the internet accessibility either has a negative effect on GDP per person engaged or just insignificant. Intuitively, internet relies on computers to be effective, not the other way around. If there is no internet, with only computers people can still work on lots of things. Thus no matter we control for internet or not, the effect of computers on GDP per person engaged will always be positive.

Although it makes sense to think about the causes, how can we explain the difference between the visual test and the statistics? To better understand this, I divided all observations into 4 quartiles based on their GDP per capita. The first group's GDP per capita ranges from 0 to 2,746; second group ranges from 27,467 to 6,852.5; third group ranges from 6,852.5 to 18,573 and forth group ranges from 18,573 to 100,000. Then I ran the same multiple regressions on the same variables, just control for different groups. You can see the results in table 4. One thing particularly interested me is that there is a clear transition from low GDP per capita countries to high GDP per capita countries. Looking at the internet accessibility's coefficients, in those countries where GDP per capita is low, the effect of internet is actually positive. As the GDP per capita goes up the effect of internet becomes more negative, but insignificant. Finally when it comes to the highest quartile, the return on internet actually becomes negative at 5 percent significant level. For number of computer users per 100 people, the coefficient is always positive and significant, and as GDP per capita goes up, the effect magnitude of pc also goes up all the way from 929 to 10410.

There are several possible explanations for these coefficients. As we discussed before, it is logical to think that after using internet efficiently for working purposes, easy access to internet will distract people from working. We know that in low GDP per capita countries, (all developing countries in the data set) For instance, China from year1990 to 1995 is covered in this sub dataset. Back then the general public doesn't even know what internet is. Elder people in rural area had not even heard of the word "computer" yet, not to mention "internet". It's hard to imagine if any individual would have easy access to internet. At this stage the use of internet is most in government, military, firms and organizations, etc where people really work during the day. Therefore people spend time productively on internet mainly for working purposes, plus there is usually a "natural time limit": 8 hours a day, 5 days a week. Then it is not surprising that the benefit of internet accessibility is positive since the productivity improved from using the internet. As a country developed, GDP per capita went up. As soon as internet access was no longer constrained in the offices, the general public started to have easy access to them. Simultaneously, it is also the turning point when the function of internet in this country is no longer just for working and being productive, it started to show the "evil" side of it. With internet access, entertainments can be more attractive than ever. The raise of online games, for example, replies on internet accessibility, but could be a huge distraction from work. Still take China as an example, the emergence of countless internet cafes is accompanies by a national debate of whether or not internet is dragging us away from work, which eventually leads to a national policy of real name registration to these internet cafes and an age control of 18. Today, in many countries with high internet accessibility, you can still observe the situation where not only students, many adults as well are addicted to online games. These kinds of distractions not only consume a lot of time that could be used for working, also they make it harder for people to focus on works on the computers since they just one click away.

When it comes to the countries within the highest GDP per capita quartile where most countries are developed countries, the use of internet is more comprehensive. Working, studying, entertaining, researching… The easy access to internet gives people more choices and reasons to use internet and stay on internet. Also, in these countries internet are everywhere and almost everyone can access it easily with little costs. And the problem is that the relationship between internet demand and supply is not as simple as the classical economics theory. Since the cost of access is already so low (you can get free internet in any Starbuck coffee shop), plus people do need to use internet, the demand for internet is very high. On the other hand, people not only just need to use internet, people tends to spend even more time on internet when there is more internet access. Moreover, the stretch of internet accessibility also corresponds with new developments on the internet which made the internet more and more interesting than before. Lastly, the internet are merging many daily activity into its domain. Facebook changed the way people chat, online library system stopped people from go to libraries, emails dragged people out of the post office, and Google, changed everyone's way of searching. There seems to have a never ending demand in use of internet. Not all of people's activities will be translate into GDP growth, but all of them will be based on the easy accessibility of internet. Thus we can see a clear trend where the easier internet access is, the less productive people are in these countries.

Someone may argue that in high GDP per capita countries, people can take more advantages from internet than in other low GDP per capita countries and thus the coefficient should be more positive rather than negative. This is very reasonable. But considering the fact that other than working, most time people spend on internet are for leisure and entertainment, the additional gain from high return of internet use by some professionals is covered by the low efficiency of general public internet usage. Nevertheless, this statement could be applied to the case of computers. As I said before, the coefficient of computer sector is significantly positive and it goes up as GDP per capita increases. It makes sense to say that one additional unit of computer in high GDP per capita will bring more returns than in a low GDP per capita country. The reason is simple. A higher GDP per capita can represent a more developed market and economy, and a wealthier public. Thus compare to low GDP per capita countries it is more likely that in high GDP per capita countries an additional computer will be used in cutting edge research or other activities that would contribute more to the GDP per person engaged. In high GDP countries the people who use these computers are more likely to be highly educated and thus its functions can be fully demonstrated when it serves for much more purposes. For example, an additional computer in a firm in low GDP per capita countries might just functions with normal applications, whereas an additional computer in high GDP per capita countries might be used for the purpose such data analysis and modeling market, etc besides its normal functions.

I also examined the lag effect of internet and computers on GDP per person engaged, suspecting that the newly equipped computer and internet facilities would not be that productive until been used for a year. Here I tried 3 versions, lag internet and computer, lag all x variables and lag all x variables for 2 years. What I discovered is that the R-square of lagged internet and computer are not as high as the previous regressions. This means the effect of new internet and computer equipments will be fully demonstrated from the first year of its use.

Next, I want to make sure that it's not anything wrong with the data that leads me to these results. We know that in order to make OLS an efficient, unbiased linear estimator, the Gauss-Markov theorem has to hold. Suppose there is a heteroskedasticity problem, then the OLS is no longer efficient, but the OLS coefficient estimates are not biased. I chose several methods to test for heteroskedasticity. First, I plotted residuals to test it visually. The result is reported in Figure 6. From the graph we can see that the chance of having heteroskedasticity in my data is pretty big. Following the visual test are several formal tests. Results of these tests are reported in table 5. The first one is White test with a null hypothesis of homoskedasticity, the second one is Cameron and Trivedi's decomposition of IM-test. With chi-sqaure equal to 43.04 and p-value equal to 0, both of them suggest that there is heteroskedasticity problem with my data. The third test is the Likelihood Ratio Test, which compare regression under assumptions of both heteroskedasticity and homoskedasticity. The likelihood Ratio test in my case is 0, this is significant under 5 percent significance level. Thus I rejected the hull hypothesis of no heteroskedasticity. Same as the conclusion of white test, the likelihood Ratio test reassure me that there is clearly heteroskedasticity problem in my data.

Knowing that there are heteroskedasticity problem, I carried out the Huber-White Robust Test to correct standard errors. This method uses var ($\beta_j$hat) = [$\sum$(w_{ji}hat)^2 * (μhat)^2] / [$\sum$(w_{ji}hat)^2]^2 as the correct standard error. You can see from Table 3 regrobust that after using corrected standard error, the t stats for both internet and computer didn't change much. Compare to the multiple regression, internet accessibility remains significantly negative and computers remains significantly positive.

Conclusion:

In this paper I examined the effect on information technology on productivity. For information technology I chose number of internet users per 100 people and number of computer users per 100 people as my measures. For productivity, I used GDP (PPP) per person engaged as measure. In all the regressions, I found a positive impact from number of computer users on productivity. The impact varies a lot from low GDP per capita countries to high GDP per capita countries. Based on the regression result one additional computer in high GDP per capita country can bring more benefit that one in low GDP per capita country. However, I found mixed results about internet's impact on productivity. The regression with time trend suggests that the impact of internet usage on productivity is insignificant, whereas other regressions suggest that internet has a negative impact on productivity. After decomposing the data into 4 groups by GDP per capita, I found that internet indeed have a positive contribution to productivity when a country has a low GDP per capita. The effect is insignificant in the middle quartiles, but significantly negative in the high GDP per capita countries. This result is similar to Dewan and Kenneth's research. The difference is that considering both internet and computer, the effect of information technology on productivity is bigger in developed countries than in developed countries. Moreover, the effect of newly equipped internet and computer facilities will be effective since the first year of use. There is no lag in order to let the effect take place.

References

Sanjeev Dewan and Kenneth L. Kraemer
Information Technology and Productivity: Evidence from Country-Level Data
http://ezproxy.bgc.bard.edu:2052/stable/2661601?seq=2

Brynjolfsson http://ccs.mit.edu/papers/CCSWP130/ccswp130.html

The Resurgence of Growth in the Late 1990s: Is Information Technology the Story?

http://www.jstor.org/stable/2647073

Oliner and Sichel, Information Technology and Productivity: Where Are We Now and Where Are We Going?
Federal Reserve Bank of Atlanta E C O N O M I C R E V I E W Third Quarter 2002

Beyond Computation: Information Technology, Organizational Transformation and Business Performance
Brynjolfsson and Lorin M. Hitt
http://ezproxy.bgc.bard.edu:2052/stable/2647074

Assessing the Productivity of Information Technology Equipment in U.S. Manufacturing Industries
http://www.jstor.org/stable/2951394

The Productivity Slowdown, Measurement Issues, and the Explosion of Computer Power
Baily and Gordon 1988 pp 350-351
http://www.jstor.org/stable/2534534?seq=5

Appendix

Tables

Table1

DEWAN AND KRAEMER

Information Technology and Productivity: Evidence from Country-Level Data

Table 1 Global IT Industry: Total Estimated Revenues Paid to Vendors of Computer Hardware, Software, Communications, and Services over 1985–1996 in Billions of Current U.S. Dollars (IDC 1997) and a Forecast for the Year 2000

Market	1985	1990	1991	1992	1992	1994	1995	1996	*2000*
Worldwide	162	367	390	417	432	473	557	630	*937*
United States	90	132	138	153	175	193	224	253	*385*
Japan	15	63	70	70	75	78	97	112	*155*
Europe	38	125	131	138	123	131	155	168	*221*
Asia Pacific (Ex. Japan)	8	18	19	21	24	30	38	47	*91*
Americas (Ex. U.S.)	7	18	21	23	23	26	30	34	*59*
Rest of the World	4	18	18	18	20	25	24	29	*44*

Table 2

Variable	Obs	Mean	Std. Dev.	Min	Max
lnintern~100	1760	0.55222	2.875747	-11.0001	4.463192
lnpcper100	1215	1.379666	1.743655	-2.30259	4.410371
lntradevol	1490	23.99668	1.886939	19.60325	28.69228

Table 3

	regsimp b/t	regsimp2 b/t	regmulti b/t	regfe b/t	regre b/t	regt b/t	regrobust b/t
lnintern~100	3056.374***		-1361.094***	-123.577*	-245.987***	60.126	-1361.094***
	(27.848)		(-9.432)	(-2.064)	(-4.168)	(0.270)	(-9.350)
lnpcper100		7267.813***	8225.703***	1374.443***	1927.687***	6694.670***	8225.703***
		(51.677)	(31.550)	(6.647)	(9.352)	(21.275)	(29.273)
lntradevol			1551.091***	3882.873***	3744.312***	1414.232***	1551.091***
			(10.021)	(11.977)	(13.852)	(9.352)	(8.933)
year						-801.439***	
						(-8.192)	
_cons	19336.186***	11627.965***	-27167.180***	-73740.007***	-71890.499***	1579714.412***	-27167.180***
	(60.181)	(37.194)	(-7.624)	(-9.550)	(-11.276)	(8.052)	(-6.840)

Table 4

	gdpcapt1 b/t	gdpcapt2 b/t	gdpcapt3 b/t	gdpcapt4 b/t
lnintern~100	545.553***	-66.980	-501.091	-1405.013*
	(3.670)	(-0.239)	(-1.052)	(-2.473)
lnpcper100	929.262***	2809.033***	6979.204***	10410.971***
	(4.113)	(5.800)	(8.870)	(10.140)
lntradevol	137.363	-254.644	-147.395	1968.655***
	(1.087)	(-1.289)	(-0.484)	(8.546)
year	-591.984***	-492.407**	-1057.438***	-248.244
	(-5.676)	(-3.068)	(-5.532)	(-1.401)
_cons	1186922.081***	1000359.443**	2125676.760***	456035.115
	(5.679)	(3.115)	(5.568)	(1.290)

Table 5

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. imtest, white

White's test for Ho: homoskedasticity
         against Ha: unrestricted heteroskedasticity

         chi2( 9)      =     43.04
          Prob > chi2  =    0.0000

Cameron & Trivedi's decomposition of IM-test
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Source	chi2	df	p
Heteroskedasticity	43.04	9	0.0000
Skewness	17.16	3	0.0007
Kurtosis	36.80	1	0.0000
Total	97.00	13	0.0000

Figures

Figure 1

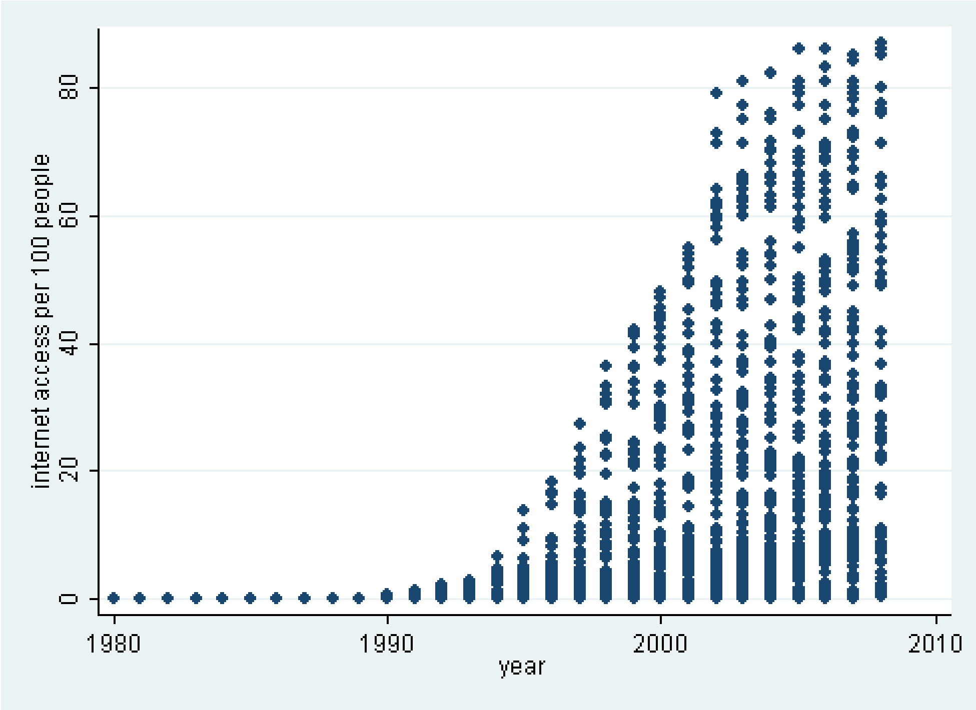

Figure 2

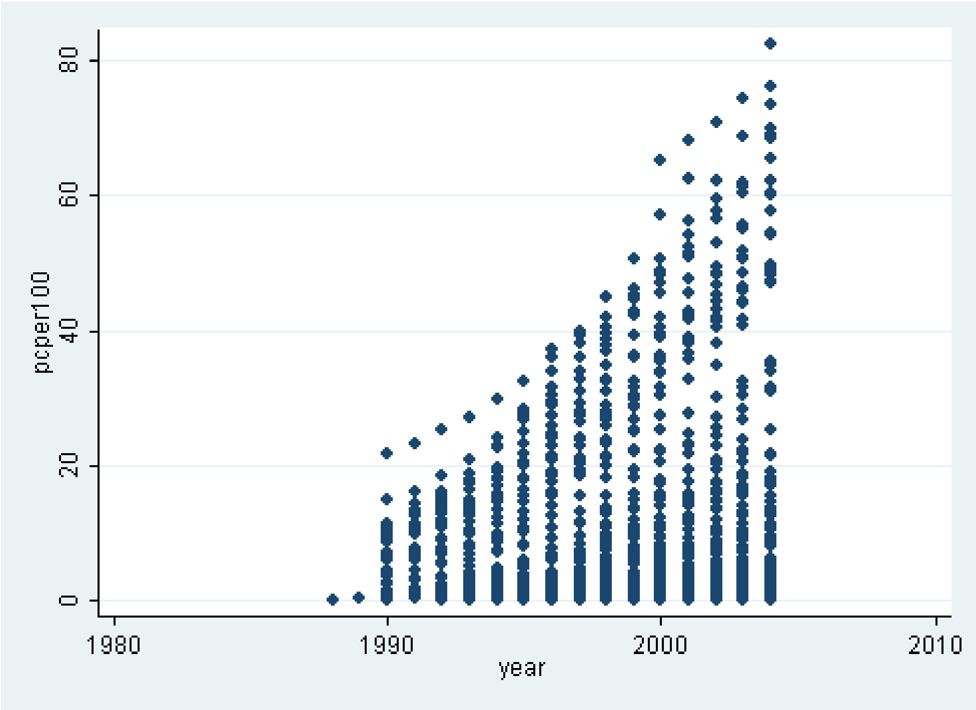

Figure 3

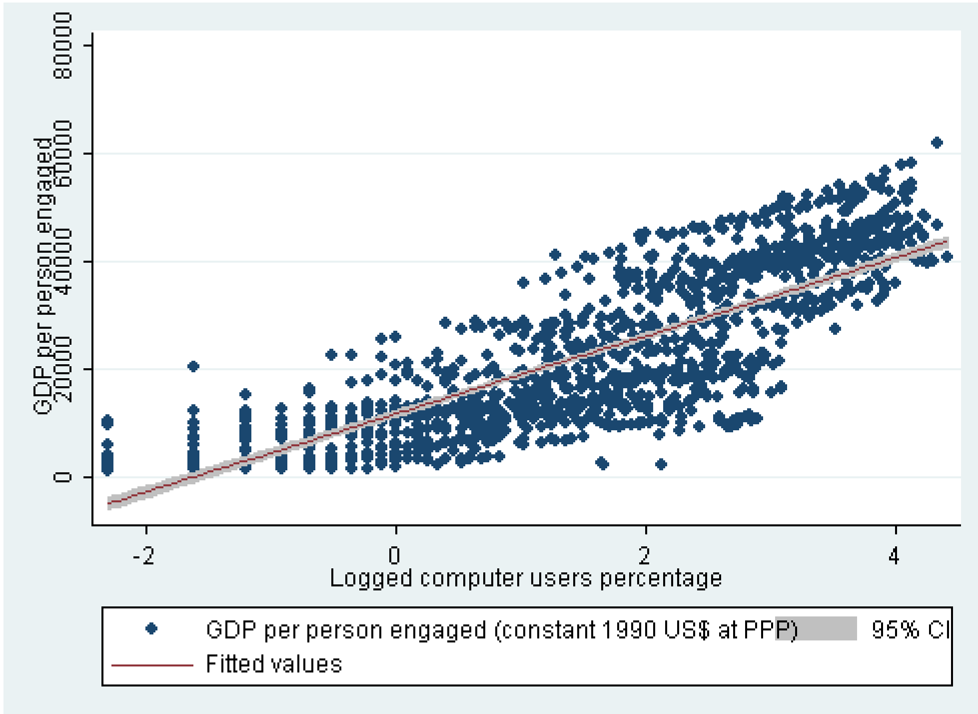

Figure 4

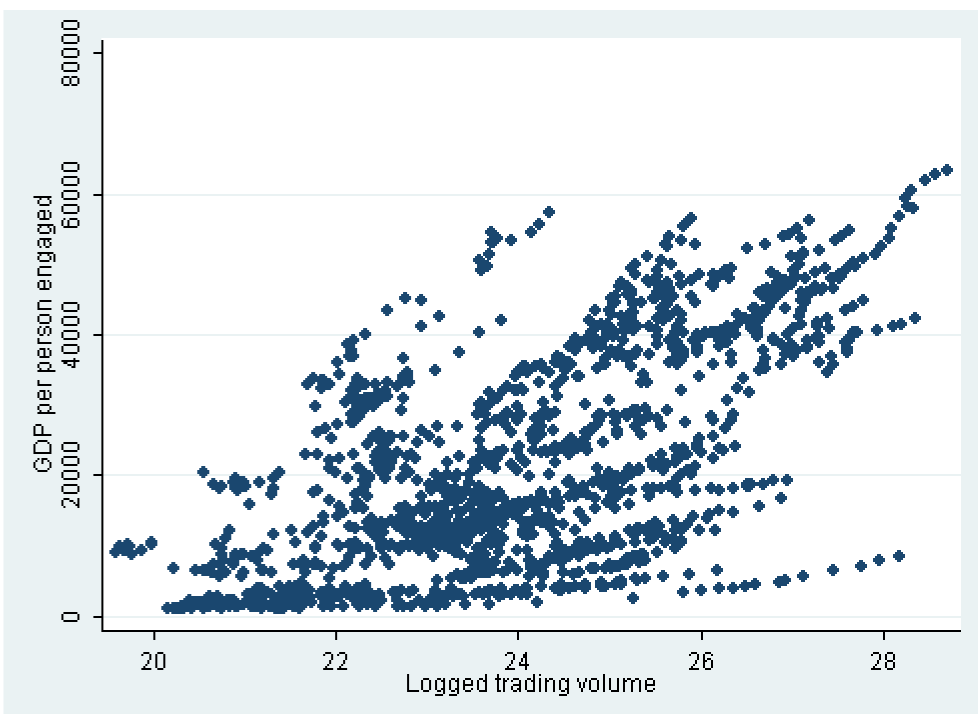

Figure 5

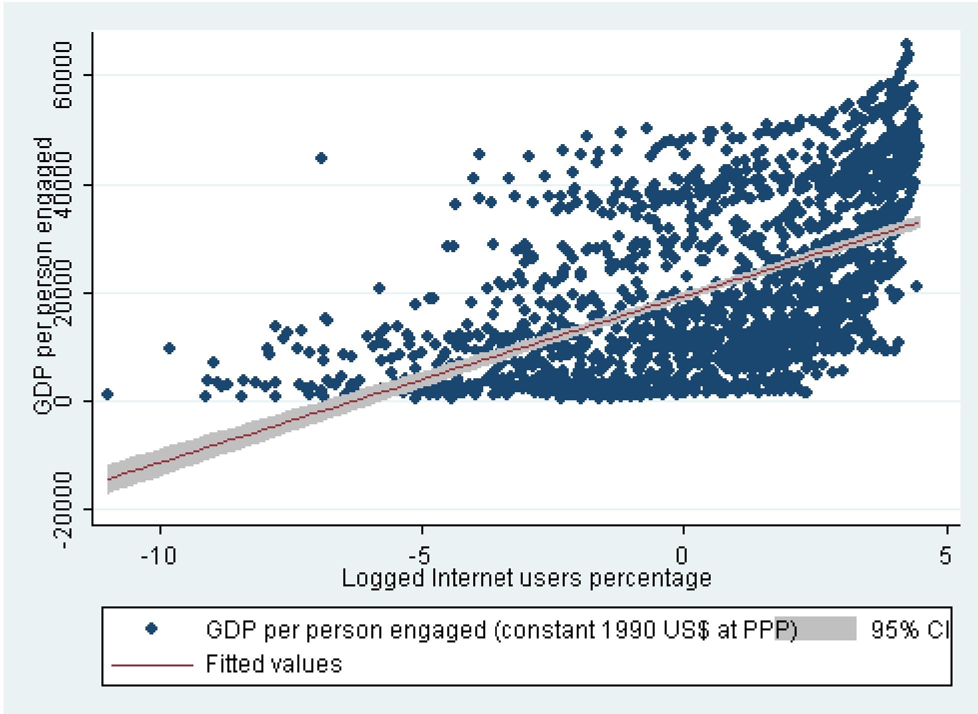

Figure 6