THE IDEA EPIDEMIC: AN ANALYSIS OF THE DIFFUSION OF ECONOMIC DISCIPLINES USING EPIDEMIOLOGICAL MODELS

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THE IDEA EPIDEMIC: AN ANALYSIS OF THE DIFFUSION OF ECONOMIC DISCIPLINES USING EPIDEMIOLOGICAL MODELS

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Abstract

In recent years, there has been increasing interest in what drives the diffusion of knowledge. Recent studies have utilized epidemiological models to track the spread and growth of new academic disciplines. This study quantitatively examines 20 years of publication data in Economics, using modified epidemiological models to find the parameters under which these fields evolve. Looking at the quantitative results for 755 JEL codes, intriguing trends are found in the data. These quantitative outputs provide interesting conclusions not only about specific JEL's, but also suggest that the characteristics of individuals in a given field can have a significant impact on the development of a field. Specifically, our results indicate that individuals who are charismatic and sociable can have a significant impact on furthering the growth of their discipline.

KEYWORDS: (Technological diffusion, Epidemiological models, JEL codes)

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CHAPTER I

INTRODUCTION

The idea of networks and their relative ‘smallness’ has captivated the human mind for centuries. The early work of Stanley Milgram, with his experiment in which he had individuals attempt to pass a letter to a stockbroker in Boston led to his conclusion about the six degrees of separation which is still widely recognized. Today, it is embodied through things such as the Wikipedia game, in which one tries to link to a certain article on Wikipedia by clicking through no more than 6 links. The advent of the internet, and social networking tools such as Facebook and LinkedIn have pointed to the increasingly small size of the world – it is becoming much easier to contact or collaborate with someone literally halfway around the globe.

There are more academic measures of networks, such as the Erdos number. Paul Erdos was a famously prolific mathematician who published somewhere in the realm of 1,400 papers. The Erdos number is essentially a measure of the collaborative distance between individuals, as measured by publications. Erdos himself is 0, a coauthor of Erdos’ is 1, someone who has coauthored with a coauthor but not with Erdos would be a 2, and so forth. These concepts of the ‘smallness’ of the world, and thus the power of networks to diffuse knowledge have intrigued not only the public but also the scientific community.

This human fascination with the diffusion of knowledge has led to academic research oriented towards explaining the mechanisms behind the spread of ideas. In recent years, the study of technological diffusion has exploded, with extensive work addressing the diffusion of innovation. More recently, there has begun to be work that looks at not just the diffusion of innovation, but the diffusion of ideas – more pure knowledge as opposed to applied. The term 'idea' in this field typically refers to any concept that can be transmitted from person to person.[1] It can refer to a technology, but it can also refer to more abstract pieces of knowledge, such as a piece of news or a colloquialism.[2] The methods and models for measuring this transmission of ideas are widely varied – some choose to use patents, while others use citation networks, and others still have used journal publications. The models in the literature are wide-ranging as well. There are econometric models, epidemiological models, and network-analyses, and likely more still. In this paper, we build upon past work with epidemiological models and journal publications to model the diffusion of scientific fields and ideas within Economics. We use the EconLit database to construct a dataset of the unique number of publications and authors for a given year for each Journal of Economic Literature (JEL) code. These time series are then utilized with a modified epidemiological model developed in the work of Bettencourt et al. to model the

[1] Luís M. A. Bettencourt, Ariel Cintrón-Arias, David I. Kaiser, and Carlos Castillo-Chávez, "The power of a good idea: Quantitative modeling of the spread of ideas from epidemiological models." *Physica A* 364 (2006): 513-536.

[2] Ibid.

emergence and spread of academic sub-disciplines.[3] We expect to find that fields that are less complex will have a shorter incubation period, and thus faster diffusion. We also expect that variables that measure interpersonal relationships will have a strong positive effect in the diffusion of sub-disciplines. Lastly, we expect to see a relatively larger and faster spread of these economic concepts than has been seen in the work of Bettencourt, because of the highly theoretical physics knowledge they were modeling.[4] The rest of the paper is organized as follows: Chapter 2 contains our Literature Review, Chapter 3 addresses the theory and methodology behind this work, as well as our specific model, Chapter 4 encompasses our data sources and methods of collection and cleaning, and Chapter 5 is composed of our results of our regression and our evaluation of their significance, and Chapter 6 is comprised of our conclusion and the possible implications of this work. Works consulted, appendices with relevant data, and graphical illustrations follow.

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[3] Luís M. A. Bettencourt, David I. Kaiser, Carlos Castillo-Chávez, David E. Wojick, and Jasleen Kaur, "Population modeling of the emergence and development of scientific fields." *Scientometrics* 75, no. 3 (2008): 495-518.

[4] Ibid.

CHAPTER II

LITERATURE REVIEW

The literature on technological diffusion is exhaustive, and we cannot hope to address all of it within the span of this paper. We do hope to provide an overview of the work that is most relevant to our study. We begin with a discussion of the various types of data that are utilized in technological diffusion models.

Prominent economists have argued that “technology and technology flows are inherently not susceptible to quantitative analysis”, due in large part to the lack of a paper trail.[1] Specifically, Krugman argues that “Knowledge flows are invisible… they leave no paper trail by which they may be measured and tracked…”,[2] and Mankiw claims, “Models that emphasize unmeasurable variables such as knowledge are hard to bring to the data.”.[3] While this may have been true at one point, we now have a few avenues available to measure knowledge flows. Patent data and citation networks yield a quantitative perspective of how knowledge is transmitted, and are commonly used in the literature, as well as slight variations and manipulations of that data.

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[1] Jonathan Eaton, and Samuel Kortum, "Measuring technology diffusion and the international sources.."*Eastern Economic Journal* 22, no. 4 (1996): 401.

[2] N. Gregory Mankiw, Edmund S. Phelps, and Paul M. Romer. "The Growth of Nations." *Brookings Papers on Economic Activity* 1995, no. 1, 25th Anniversary Issue (1995): pp. 275-326.

[3] Krugman, Paul. *Geography and Trade.* 1st ed. MIT Press, 1992:53

Data

Two main strands of work dominate the literature. One is work that focuses more on the diffusion of innovation, or more commercial ideas; the other is the diffusion of pure knowledge, or diffusion of academic ideas. In the following section we discuss how different data sets are utilized, dependent on whether we are measuring the spread of more commercial ideas, or measuring the diffusion of knowledge. Our literature review focuses mostly on work regarding the diffusion of pure academic ideas, but we address briefly the work covering more commercial diffusion. The most salient difference between commercial and academic ideas is that commercial knowledge is the applied form of the academic knowledge. While some of the same factors are salient in informing its diffusion, there are also other factors that influence it as well. For instance, we see trends in products and commercial goods that we presumably do not see in academic ideas. For instance, products such as Silly Bandz, Pokemon, or Furbies - while all no doubt innovative products - inexplicably trended, when there was no quantifiable reason they should have been so successful on the market. This phenomenon has been explored in the work of Gladwell[4], and in the work of the Heath brothers.[5] These same, unquantifiable tipping factors theoretically do not have the same applicability to knowledge. While patents do not entirely represent these challenges, because ideas that never go to market may be patented, this dilemma is inherently more present in the work that uses patents. In spite of these differences, we

[4] Gladwell, Malcolm. *The Tipping Point.* Back Bay Books, 2002.

[5] Heath, Chip, and Dan Heath. *Made to Stick: Why Some Ideas Survive and Others Die.* 1st ed. Random House, 2007.

evaluate both the literature that is applicable to commercial and academic ideas, because there is overlap and merit in both fields.

Patent Data

One of the most common means of measuring technological diffusion is through patent data. Patents are presumably a physical manifestation of innovation; as you innovate, you protect and document your idea through the patent process. This is a much more commercial and applied notion of knowledge to be sure – the purpose of patents is to ensure the future marketability of a product. Nonetheless, it is a measure of innovation and knowledge. The most salient example of this in the literature is in the work of Johnson and Evenson, and of Eaton and Kortum. In Johnson and Evenson's paper, the use of patents is documented in Africa to model the technological spillover Africa is receiving.[6] In Eaton and Kortum's paper, patents are used as a measure of countries innovative output.[7] Their model is specifically formulated to address the assumptions implicit in using patents, particularly when modeling patterns of technological diffusion.[8] They model the decision to patent explicitly, with variables for the cost of patenting in country *n*, the strength of information property rights (IPR's), the overall productivity levels, and the diffusion parameter.[9] With their choice of variables, these models capture some of the challenges of measuring diffusion through

[6] Daniel K. N. Johnson, and Robert E. Evenson, "How Far Away Is Africa? Technological Spillovers to Agriculture and Productivity." *American Journal of Agricultural Economics* 82, no. 3 (2000): pp. 743-749.

[7] Eaton and Kortum, 402-403.

[8] Ibid.

[9] Ibid.

patents, such as the issue of heterogeneous patenting systems. These concerns about using patents are relatively widespread in the literature, and there is work that specifically addresses how the strength of IPR's affects the decision to patent. In spite of these limitations, Eaton and Kortum ultimately dispute the notion that there are no paper trails in innovation – they hold that patents are paper trails. Eaton and Kortum state that they have successfully used patents to quantify the contributions of technology to economic growth and productivity, and subsequently determine how countries innovations benefit each other.[10] While they are not a perfect measure of innovation, patents are widely accepted as one of the better (and more readily accessible) measures of innovation.

Citation and Publication Data

The other most common measure of knowledge flows is through citations and academic publications and networks. These are again ostensibly a physical manifestation of ideas; publications document new ideas or theories and are a way of introducing them to others in your discipline. Unlike patents, they are much more academic and theoretical –while there may be a marketable application of an idea, journal articles are not specifically designed for that purpose. There are a multitude of examples of the use of these data in the literature, and different authors utilize the journal and citation data differently. Data that is frequently utilized from these databases is that of co-authorship, citation networks, and numbers of publications and authors in a given field. Newman, who works with scientific collaboration networks identifies two main benefits of using citations and journals in the work of technological

[10] Ibid.

diffusion. Firstly, traditional studies of networks are labor intensive in that they require surveys or interviews to determine ties or connections between individuals, thus limiting the size of the network that can be analyzed.[11] Secondly, the studies are sensitive to the bias of the individuals and the respondent's perception of connection or friendship with others.[12] As a result, it is beneficial to use networks that have larger data sets available, and are more objective – previous examples include the electric power grid, the internet, and air traffic in airports.[13] The key difference between these networks and citation networks is that these examples do not guarantee face-to-face contact (and are also not applicable to the work of technological diffusion). Scientific co-authorship and citation, while not a perfect guarantee of face-to-face collaboration, is a relatively strong measure. Similarly, there is also work that examines the motivation behind citation and what increases the odds of citation in scientific journals.[14] The benefit of using academic databases of publications is also that the knowledge is confirmed as valuable by others in the community. Because articles are peer-reviewed before publish, they must receive the approval of others in the community as valuable before entering the communal pool of knowledge. This makes it different from the information that is for instance put forth on the internet, where anyone can contribute to the common knowledge, regardless of their expertise or accuracy. This vetting process via publish legitimizes the content as desirable knowledge to some extent. Overall, we

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[11] M. E. J. Newman, "The structure of scientific collaboration networks." *Proceedings of the National Academy of Sciences of the United States of America* 98 (2000): 404-409.

[12] Ibid.

[13] Ibid.

[14] Daniel K.N. Johnson, "Getting Noticed in Economics: Determinants of Citations to Journal Articles". *American Economist* 41, no. 1 (1987): 43-52.

see that these journal databases are a useful measure of knowledge because they provide a traceable measurement of knowledge, with more objectivity, and a larger data set than traditional measures of networks. As referenced before as well, the use of journal articles does not have to contend with such a heterogeneous system. The publishing process is relatively standardized (although the standards for publish may vary), regardless of the journal, country, or language, while the choice to patent or network data via interviews may be informed by a variety of factors.

Journal publication data is used and gathered in a variety of ways. One main usage is that of Newman's, who evaluates citation networks, and looks at the linkages between co-authors.[15] There are services (CiteSeerX is one common example) designed to model exactly these networks, and track the number of citations any given article receives. Another use of citation data is found in the work of Kaiser and Bettencourt. They utilize the total number of unique publications and unique authors for a given year to model time series data, but without tracking the specific connections between individuals as in Newman's work.[16] The data for this is from varied sources. In Kaiser's work on Feynman diagrams, he exhaustively constructs a database of the spread of Feynman diagrams based on his personal knowledge of where they appear in the literature, because they are not always appropriately cited.[17] It is if anything, a case

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[15] Newman, M. E. J. "Scientific collaboration networks. I. Network construction and fundamental results." *Physical Review E* 64, no. 016131 (2001).

[16] Luís M. A. Bettencourt, Ariel Cintrón-Arias, David I. Kaiser, and Carlos Castillo-Chávez, "The power of a good idea: Quantitative modeling of the spread of ideas from epidemiological models." *Physica A* 364 (2006): 513-536.

[17] David Kaiser, Kenji Ito, and Karl Hall, "Spreading the Tools of Theory: Feynman Diagrams in the USA, Japan, and the Soviet Union." *Social Studies of Science* 34, no. 6 (2004): pp. 879-922.

study of a specific sub discipline. Bettencourt's work, more comparative and cross-disciplinary, is less of a case study – they use search strings in academic databases to scrape the total number of authors and publications for a given year.[18]

Patents, and journal and citation data, are the two main data sets used in measuring technological diffusion. The advantage to both is that there is a large, objectively evaluated dataset that is widely available. One of the significant differences between these two datasets, besides the unique problems each one presents, is that patents are more of a measure of commercial innovation, while journal publications are more a measure of academic innovation and diffusion. In our theory section we will address which dataset we choose to use and why.

Models and Methodology

Another aspect to evaluate in the literature is the models and methodology used. The literature can be roughly split into three main types of modeling: econometric, network or computational and epidemiological models. Again, we cannot hope to provide a complete overview of all work where these models are represented, so we choose to focus on the few works most relevant to our research.

Econometric Models

We choose to focus on two papers for the econometric models; Johnson's "How Far Away is Africa", and Eaton's "Measuring Technological Diffusion". In Johnson's paper, he utilizes an econometric model that has the protected research & development

[18] Luís M. A. Bettencourt, David I. Kaiser, Carlos Castillo-Chávez, David E. Wojick, and Jasleen Kaur, "Population modeling of the emergence and development of scientific fields." *Scientometrics* 75, no. 3 (2008): 495-518.

(R&D) stock as the dependent variable, and a string of explanatory variables that describe the relevance of the technology through measures of similar climate, training, consumer income, and market size.[19] He then uses the Heckman technique and the Mills ratio to estimate the equation with a dataset of patents.[20] The results from this estimate are then used to determine which factors are salient in the diffusion of technology.[21] In Eaton's paper, output and productivity are the dependent variables, with an array of explanatory variables capturing inventiveness and the strength and capability of countries to adopt those innovations.[22] They then infer the parameters by fitting the steady state model to existing data on productivity levels, productivity growth, international patenting and research activity.[23] These are both examples of the types of econometric modeling, which are used in the literature, although they have slightly different approaches. We cannot hope to cover all of the literature, but we do find these to be two of the more relevant examples of econometric models applied to the diffusion of knowledge. One salient note is that the econometric models we see in the literature typically utilize patent data and not journal data. This is an important distinction for our work.

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[19] Johnson and Evenson, 745-748.

[20] Ibid.

[21] Ibid.

[22] Eaton and Kortum, 402-403.

[23] Ibid.

Network Analyses

The second type of modeling we see in the literature is that of network analyses, represented most robustly through the work of Newman. Firstly, the work of studying social networks is not inherently the domain of economists. It has been exhaustively explored by sociology, and as of late, it has begun to be explored by physicists, who have found that statistical physics techniques are well suited to the analysis of network patterns.[24] This is where Newman's work falls. We cannot hope to review all of the literature on social networks and choose to focus on a subset of the literature because of their quantitative measures and models, as well as their relevance to the topic of diffusion. Three of Newman's pieces utilize citation networks, specifically the co-authorships between individuals in a given field.[25] Co-authorship is chosen because it is taken as a good indicator of true friendship or acquaintance.[26] Presumably one is not co-authoring papers with someone one has have never met. While the advent of the internet has made it easier to do so, on the whole most academics would agree that co-authorship requires some face-to-face interaction or personal communication. Thus, Newman examines the networks of citation and co-authorship for his work. Newman's papers, as well as Bettencourt's, focus exclusively on the physical science fields – computer science, physics, and mathematics. He does not address the social sciences in his work. For his first two papers addressing social networks he constructs collaboration

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[24] Newman, 404-409.

[25] M. E. J. Newman, "Scientific collaboration networks. I. Network construction and fundamental results." *Physical Review E* 64, no. 016131 (2001)

[26] Ibid.

networks from the available data, and finds a best fit model to explain the data.[27] They gather network statistics from the data about the total number of authors, total number of papers, mean authors per paper, mean papers per author, and clustering coefficients.[28] From these data they construct collaboration networks and lines of best fit where appropriate.[29] They find that the distribution of quantities such as papers per author, and author per paper, roughly follow a power-law form.[30] Their work also finds that within the 'giant component' of the field, any two scientists can be connected by a short path.[31] In Newman's third paper, he uses much of the same models to examine what is exactly the shortest path. He utilizes a modified standard first-breadth search algorithm to determine the shortest path between individuals.[32] He finds that the typical distances between authors are small, creating a "small world" of literature, but, for most authors the bulk of paths are 'funneled' through one or two scientists, who act as hubs to the majority of the scientific community.[33] Overall, his work is a different portrait of the diffusion of knowledge, with more of an emphasis on the linkages between authors, and how that affects the transmission of ideas. Supplementary to this work is Garfield's 1980 piece on the spread of scientific information. He gives a brief overview of the

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[27] Newman, 404-409.

[28] Ibid.

[29] M. E. J. Newman, "Scientific collaboration networks. I. Network construction and fundamental results." *Physical Review E* 64, no. 016131 (2001)

[30] Newman, 404-409.

[31] Ibid.

[32] M. E. J. Newman, "Scientific collaboration networks. II. Shortest paths, weighted networks, and centrality." *Physical Review E* 64, no. 06132 (2001)

[33] Ibid.

genesis of the ‘epidemiology of knowledge’, but also provides review of other work that corroborates that of Newman’s. In one study he references, in a literature population of 1,123 authors, only 66.4% (703), were active for one year.[34] Only 53 authors (4%) were active for the entire ten year period of the study.[35] It would fit that these 4% that are consistently in the field act as hubs for the other individuals who publish in this work, and thus we see such funneling as in Newman’s work. This emphasis on linkages between authors is also corroborated by the work of Singh, which finds that firm and regional boundaries are a reflection of underlying inter-personal relationships and the limitations or clustering those relationships impose.[36] This network analysis is the second methodology that dominates the literature. One thing of note is that for network analyses, in contrast to the econometric models, the data used is exclusively journal and citation data. Patents have not been used in the same way.

Epidemiological Models

The last strand of methodology we see represented in the literature is that of Bettencourt and Kaiser – epidemiological models. Now, the analogy between disease and knowledge is not perfect. Firstly, unlike a disease, people normally consider it beneficial to acquire an idea.[37] It is usually an intentional act by the transmitter which

[34] E. Garfield, "The Epidemiology of Knowledge and the Spread of Scientific Information." *Essays of an Information Scientist* 4 (1980): 586-591.

[35] Ibid.

[36] Singh, Jasjit. "Collaborative Networks as Determinants of Knowledge Diffusion Patterns." *Management Science* 51, no. 5 (2005): pp. 756-770.

[37] Bettencourt, Kaiser, Castillo-Chávez, Wojick, and Kaur, 497-516.

allows the idea to spread.[38] Additionally, there is no process through which one can automatically deflect an idea.[39] With a disease, the immune system can fight the invasion of a disease.[40] With an idea, there is no automated reaction to expel it in the same way.[41] Additionally, with ideas there may be a period of learning or apprenticeship that is not evident in diseases in the same way.[42] Another key difference is that publishing and archiving create reservoirs of knowledge that can exist even once the initial infector or originator has disappeared.[43] Additionally, ideas may encounter stiflers or resistors who actively combat the spread of an idea.[44] The idea of stiflers is considered roughly parallel to the idea of vaccination in a traditional epidemiological model.[45] Lastly, while you may gain immunity from disease once you have been exposed, an idea has no such permanent immunity and can recur again and again, whenever deemed useful.[46] As a result, people may have different behavior and approaches when acquiring or exposed to an idea, as opposed to when they are exposed to a disease.

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[38] Ibid.

[39] Ibid.

[40] Ibid.

[41] Ibid.

[42] Ibid.

[43] Bettencourt, Cintrón-Arias, Kaiser, and Castillo-Chávez, 515-524.

[44] Ibid.

[45] Ibid.

[46] Ibid.

However, epidemiological models are still useful as explanatory frameworks for ideas. They can effectively validate statements about how effective transmission of an idea is, the size of the susceptible population, the speed of spread, and its persistence. As a result, we find them to be a useful model for the transmission of knowledge. Basic epidemiological models traditionally have three stages – a SIR model. There is a susceptible population (S), infected population (I), and recovered (R). There are slight variations on this (SIS, SEIR, see Hethcote for a more complete analysis of the field), but the base is an SIR.[47] In Bettencourt's work, there are two modified models that are utilized. In "The Emergence of Scientific Fields", they utilized an SEIR model.[48] The E accounts for the exposed population; that is those that have been introduced to the concept, but have not yet adopted it. This accounts for the idea of an apprenticeship period, or an incubation period.[49] Parameters in the model include standard latency time, probability and effectiveness of contact with an adopter, average duration of apprenticeship, duration of infectious period, and probability that an infected individual has multiple and effective contacts with other susceptibles.[50] Parameter estimation in then performed with stochastic ensemble algorithms. The other model Bettencourt utilizes, in "The Power of a Good Idea", is again a modified SIR model, this time a SEIZR model.[51] Again, E is the exposed class, but this time we also have the addition of

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[47] H. W. Hethcote, "The Mathematics of Infectious Disease." *Society for Industrial and Applied Mathematics Review* 42, no. 4 (2000): 599-653.

[48] Bettencourt, Kaiser, Castillo-Chávez, Wojick, and Kaur, 497-516.

[49] Ibid.

[50] Ibid.

[51] Bettencourt, Cintrón-Arias, Kaiser, and Castillo-Chávez, 515-524.

Z – a detractors class. This accounts for those who are actively fighting the spread of the idea – particularly vehement critics or those who try to stifle the idea.[52] These are the two modified epidemiological models represented in the literature on technological diffusion, specifically with regards to the work of Bettencourt.[53] For a more complete review of all historical work with the application of epidemiological models to knowledge flows, we recommend consulting the work of Tabah, which provides a comprehensive picture.[54]

There are a few other things to be addressed regarding the application of epidemiological models to technological diffusion. Firstly, it is important to note that there is currently no use of epidemiological models with patents. They are used exclusively with time series data constructed from journal and publication data. Secondly, the susceptible population poses a problem to identify – both in disease models and in knowledge models.[55] One can consider the entire population, but should spreading be facilitated only by something such as face-to-face contact, that is a significant overestimation of the true susceptible population.[56] In hindsight, we can see what the true susceptible population is, but estimating such numbers beforehand leaves the possibility for an error of underestimation.[57] Lastly, there are other applicable

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[52] Ibid.

[53] Ibid.

[54] Tabah, Albert N. "Literature Dynamics: Studies on Growth, Diffusion, and Epidemics." *Annual Review of Information Science and Technology (ARIST)* 34 (1999): 249-86.

[55] Bettencourt, Kaiser, Castillo-Chávez, Wojick, and Kaur, 497-516.

[56] Ibid.

[57] Ibid.

epidemiological statistics that can be applied to the spread of ideas. One is R0, which is the invasion criterion in a population of susceptibles.[58] The R0 number tells of whether or not an idea will spread, and how effective its spread will be.[59] These statistics are of use in the diffusion of knowledge as well.

This summarizes the three main models that dominate the literature on the diffusion of knowledge and innovation - econometric models, network analyses, and epidemiological models. Overall, there is good precedent in the literature for using any or all of these models to predict the spread of ideas.

Variables

The last thing to address is which variables can be considered explanatory in modeling the diffusion of knowledge. Which variables are chosen for inclusion varies widely throughout the literature. These variables depend simply on what the author wishes to explain, what is plausible to include, or what they believe merits inclusion. Throughout the literature there is a trend of inclusion of three main variables. Those variables are distance, complexity of material, and face-to-face contact.

Distance as an Explanatory Variable

The paper that is most concerned with distance as an explanatory variable is Johnson's, which focuses on distance as a determining factor for technological spillover. In Johnson's paper, distance is measured not only as physical distance, but also as 'proximity' to nations through measures such as similar GDP size, similar per capita

[58] Ibid.

[59] Ibid.

income levels, and similar collections of crop and livestock.[60] Clearly, this is a much more commercial measure, given that with knowledge, a country's agricultural output likely has little to do with adoption of ideas. However, the idea of distance as a determining factor is relevant (and in some ways linked to the idea of face-to-face contact). Examples such as Silicon Valley's IT industry, or Boston's Biotechnology community are frequently cited as examples of the importance of location.[61] The work of Jaffe focuses heavily on geographic clustering and spillover, finding that in the case of patent citations, there is significant localization effect, which diminishes only slightly over time.[62] Jaffe also finds that on an international level, inventors are more likely to cite domestically, again creating a localization effect on a country-wide level, as well as a community level.[63] This localization effect also fades slowly over time, as patents are absorbed into the "base" knowledge, and thus become more likely to be cited, regardless of their locality.[64] Research also addresses the role of research institutions and universities ("knowledge hubs") in driving geographic localization. Jaffe finds that there is a considerable effect from university research on patents particularly in the areas of Nuclear Technology, Drugs and Medical Technology, Optics, and

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[60] Johnson and Evenson, 745-748.

[61] Adam B. Jaffe, "Real Effects of Academic Research." *The American Economic Review* 79, no. 5 (1989): pp. 957-970.

[62] Adam B. Jaffe, Manuel Trajtenberg, and Rebecca Henderson, "Geographic Localization of Knowledge Spillovers as Evidenced by Patent Citations." *The Quarterly Journal of Economics* 108, no. 3 (1993): pp. 577-598.

[63] Adam B. Jaffe, and Manuel Trajtenberg, "Flows of Knowledge from Universities and Federal Laboratories: Modeling the Flow of Patent Citations over Time and across Institutional and Geographic Boundaries." *Proceedings of the National Academy of Sciences of the United States of America* 93, no. 23 (1996): pp. 12671-12677.

[64] Ibid.

Electronics.[65]. There is also significant other work by Trajtenberg[66] and Wejnert that shows evidence of geographic clustering in the spread of innovations.[67] Presumably, this is because location affects the frequency of communication and the level of personal relationships maintained between individuals, which in turn affects their disposition and capability to acquire new ideas from their peers. Kaiser cites this in his work on Feynman diagram, showing that in most cases the work made significant gains mostly through small lab groups that were relatively geographically close, and interacted and explored the diagrams with the aid of the others.[68] In this day and age, with the advent of the internet, theoretically distance should have decreasing value (and some studies have found that it does), however, there are many proponents who say that distance still has significant value in the diffusion of ideas, and indeed, the literature reflects this sentiment.

Interpersonal Relationships as an Explanatory Variable

Related to this notion of distance is the explanatory variable which captures face-to-face contact, or the level of interpersonal relationships. Some would argue this is also a form of distance, or is where distance has the most significance in that it diminishes the intimacy of personal relationships, and thus their efficacy in transmitting ideas. Newman's work, given that it's focused significantly on social networks, is very

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[65] Jaffe, 960-970.

[66] Manuel Trajtenberg, and Shlomo Yitzhaki, "The Diffusion of Innovations: A Methodological Reappraisal." *Journal of Business & Economic Statistics* 7, no. 1 (1989): pp. 35-47.

[67] Barbara Wejnert, "Integrating Models of Diffusion of Innovations: A Conceptual Framework." *Annual Review of Sociology* 28 (2002): pp. 297-326.

[68] Kaiser, Ito, and Hall, 879-922.

focused on this. Among other things, he finds that even within scientific fields, networks are dominated by a few key players, who serve as the hub through which others interact.[69] These personal connections as such, are key in the diffusion of these ideas. Wejnert addresses this as well, although in a slightly different fashion. She finds that not only does closeness between members of a network affect adoption, but characteristics of the individuals themselves may impact the adoption.[70] For instance, the number of friends or advisees one has in the network may affect your adoption rate.[71] Also of note are the frequency of interactions (again, potentially influenced by geographic distance), and the openness of communication or level of privacy within a network.[72] An actor's prestige and authority may also affect the likelihood of adoption.[73] She also discusses in detail the applicability of social interaction as an explanatory variable in more commercial settings, and finds that while many of the influences are similar, things such as organizational management and the measures taken to enact new ideas also play a significant role.[74] On the whole, face-to-face contact is represented in the literature as a key variable, which is relatively closely linked with that of geographic distance.

[69] M. E. J. Newman, "Scientific collaboration networks. II. Shortest paths, weighted networks, and centrality." *Physical Review E* 64, no. 06132 (2001)

[70] Wejnert, 299-320.

[71] Ibid.

[72] Ibid.

[73] Ibid.

[74] Ibid.

Complexity of Material as an Explanatory Variable

The last variable we see commonly occurring in the literature is the complexity of the material. Bettencourt alludes to this frequently with the use of his incubation period; it is assumed that the more complex the material, the longer the incubation period.[75] This implicitly speaks of the effect that the difficulty of the idea has. Mukoyama also focuses on this in his work, although with a more commercial approach again. He envisions a trade-off between adoption and complexity of machine; as technology matures it becomes more user-friendly and more reliable, which results in a spike in adoption.[76] Having a certain skill level is necessary for adopting the technology in the first place, but especially so if you are to be an early adopter.[77] His work is corroborated by Bartel[78], which shows that there is a positive correlation between skill and new technology adoption, and by Caselli, who analyzes the diffusion of computers among countries and finds that the human capital level is an important determinant in the diffusion of computers.[79] Wejnert also identifies level of prior knowledge (and thus complexity of the material) as a factor in adoption.[80] She categorizes the learning

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[75] Bettencourt, Kaiser, Castillo-Chávez, Wojick, and Kaur, 497-516.

[76] Toshihiko Mukoyama, "Diffusion and Innovation of New Technologies Under Skill Hetergeneity." *Journal of Economic Growth* 9, no. 4 (2004): 451-479.

[77] Ibid.

[78] Ann P. Bartel, and Frank R. Lichtenberg, "The Comparative Advantage of Educated Workers in Implementing New Technology." *The review of economics and statistics* 69, no. 1 (1987): pp. 1-11.

[79] Francesco Caselli,and Wilbur John Coleman II, "Cross-Country Technology Diffusion: The Case of Computers." *The American Economic Review* 91, no. 2, Papers and Proceedings of the Hundred Thirteenth Annual Meeting of the American Economic Association (2001): pp. 328-335.

[80] Wejnert, 299-320.

process as an indirect cost, in that while non-monetary, there is an opportunity cost incurred from having to retrain your labor force with the new innovation or process.[81] All of this is applicable to more pure knowledge as well. As anyone who has ever taken a math class (or any other class for that matter) can tell you, differential equations are not something you just learn overnight. There is a learning curve, and the complexity of the material can severely affect the speed of that process. This is well documented in the literature.

There are other variables that are considered explanatory as well, some that are more applicable to commercial innovations (facility changeover costs, for example), and some that are more generalized. For a more thorough review of all the possibilities in the literature, see Wejnert, who documents them more thoroughly than we can hope to in this work.[82]

Overall, the literature on technological diffusion is robust. We have given a brief overview There is strong precedent for this sort of work, with a wide variety of datasets, models, and variables to draw upon. Our work is unique in that it fills a niche not yet occupied by utilizing previously pioneered epidemiological methodology but with a humanities dataset that is yet unevaluated in the literature. We draw upon this past work in choosing how to model our data, as well as in what variables merit inclusion.

[81] Ibid.

[82] Ibid.

CHAPTER III

THEORY AND MODEL

Theory

There is extensive work in the field of technological diffusion, and there are many different approaches to what data to use, and what model and methodology. For our paper, we choose to build significantly on the work of Bettencourt et al, which utilizes a more biological model than econometric.[1] We choose to pursue the more academic strand of work, in part because the work in that field is incomplete, but also because the data is more robust and widely available. The significant difference between our work and previous work is that we are the first study we know of to pursue a comparison of diffusion of knowledge in the humanities, as opposed to in the physical sciences. The work of Bettencourt, Newman, and Garfield all operate within physical science disciplines. Our paper fills this niche by looking at the diffusion of knowledge in humanities disciplines, specifically Economics. In this paper we utilize journal publication data from the EconLit database. The reasoning for selecting these data is because of the homogeneity of the data. All of the published articles in EconLit are coded with JEL classification codes. These are a 4-character code, which denotes which fields of economics an article is considered relevant to. Unlike keywords or other tags

[1] Luís M. A. Bettencourt, David I. Kaiser, Carlos Castillo-Chávez, David E. Wojick, and Jasleen Kaur, "Population modeling of the emergence and development of scientific fields." *Scientometrics* 75, no. 3 (2008): 495-518.

though, they are not self-classified. JEL codes are maintained and assigned by the Journal of Economic Literature, creating an objective and consistent measure of what subfield an article falls into. In addition to the fact that the EconLit database is the largest and most well-respected repository of Economic literature, this makes it an ideal choice for our purposes. While our method of classification of subfields is different from that of Bettencourt's, we utilize the same dataset in the end, by creating a time series of data for the unique number of published articles and the unique number of authors for a given year.

In terms of model, our work is also relatively congruent with that of Bettencourt's. The literature shows a wide range of models, from econometric to network analyses to biological. Examining the literature, we find the majority of econometric models are utilized in conjunction with patent data, presumably because of the nature of patent data. The majority of journal data has been analyzed with network systems or epidemiological models. Not being well versed in the field of network analyses and finding it not ideally suited to our goals, we choose to instead use modified epidemiological models, as Bettencourt does. Examining the progression of Kaiser and Bettencourt's work over time, we find they are increasingly well fit to the spread of knowledge, as is discussed in their conclusions. The inclusion of parameters such as an incubation period helps make the model significantly more robust. As such, we choose to use an epidemiological model in our work as well.

The specific derivation of these variables will be detailed in our data and methodology section. Ultimately our work is building upon the work of Bettencourt et al.'s "Population Modeling of the Emergence of Scientific Fields".[2] This approach to the work allows us to integrate and build upon the salient aspects of past literature. At the same time, our work meets a previously unaddressed need, in that it evaluates the humanities, which are a previously unaddressed arena, as well as uses an arguably more objective data set than in past work.

Model

We begin our model with a generalized SEIR model from epidemiological literature. We include the standard susceptible (S), infected (I), and recovered (R), but we also choose to include a class of exposed (E) persons, who have may have exposure or familiarity with an idea, but have yet to begin publishing in that field. This is to account for the concept that in academia one does not immediately jump from student to professor. There is a period of apprenticeship or training through which one refines their knowledge. Even established professors and scientists do not jump recklessly from one field to another; they must first be exposed to the idea and gain knowledge of it before choosing to publish in it. Previous literature supports the decision to include an exposed class, most notably the work of Bettencourt and Kaiser.[3] Given the decision to utilize a four part model, we derive our equations to be as follows:

$$\frac{dS}{dt} = \Lambda N - \beta S\left(\frac{I}{N}\right), \qquad \frac{dE}{dt} = \beta S\left(\frac{I}{N}\right) - \kappa E - \rho E\left(\frac{I}{N}\right),$$

$$\frac{dI}{dt} = \kappa E + \rho E\left(\frac{I}{N}\right) - \gamma I, \qquad dR/dt = \gamma I$$

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[2] Ibid.

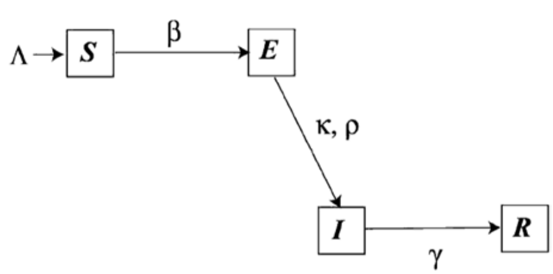
[3] Luís M. A. Bettencourt, David I. Kaiser, Carlos Castillo-Chávez, David E. Wojick, and Jasleen Kaur, "Population modeling of the emergence and development of scientific fields." *Scientometrics* 75, no. 3 (2008): 495-518.

where *S(t)* is the size of the susceptible population at time *t*, *I(t)* is the size of the infected population at time *t, E(t)* is the size of the exposed population at time *t*, and *R(t)* is the size of the recovered class at time *t*. *N* is the sum of all the values, or $N=S+E+I+R$.

The parameters in the model are also drawn from Bettencourt's work, as well as standard epidemiological literature, and are as follows: Λ is the exponential growth rate of the equation applied to *N*; β is the probability and effectiveness of contact with an adopter; $1/\kappa$ is the standard latency time, which in this case translates to the duration of apprenticeship; $1/\gamma$ is the duration of the infectious period, which in this case translates to how long one publishes on the topic; ρ is the probability that an exposed person has multiple and effective contacts with other adopters.[4] This model can be visualized as shown in Figure 3.1:

FIGURE 3.1[5]

VISUALIZATION OF FLOW OF SEIR MODEL



These parameters have loose translations to some of the explanatory variables we have described in our literature review. For example, duration of apprenticeship is inversely

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[4] Ibid.

[5] Ibid.

related to the complexity of an idea. Presumably the more complex an idea is the longer it takes to master, and thus you will see an extended period of apprenticeship. ρ and β implicitly cover some of the concepts of geography and network clustering that was previously addressed.

To estimate the parameters, we base our methodology off of Bettencourt's work which fits with traditional epidemiological models. However, we modify it to be more suited to the Economics discipline. Bettencourt's work utilizes a stochastic ensemble algorithm that runs strings of the data until they converge upon the best fit for the data, thus generating the parameters[6]. For our equations, we use the method of fitting a set of non-linear equations using feasible generalized non-linear squares (FGNLS). It is an iterative process which runs the equations simultaneously and converges on the best fitted values for the parameters. This is essentially maximum likelihood estimation, a common model in Economics. For our purposes, this is close to the process used by Bettencourt and epidemiological models, in that it finds the parameters that are most likely given the represented data set, or a best fit for the parameters. This is assuming a normal distribution. For our data, we run the system of equations by JEL code, generating a unique set of parameters for each JEL code, and thus each economic subfield.

The significant difference between the maximum likelihood methodology we are employing and the stochastic process that Bettencourt utilizes is the randomness that is incorporated into his. Traditionally epidemiological models are stochastic because the spread of disease is considered to have some non-deterministic aspect, or random

[6] Ibid.

element, in addition to the observed explanatory variables. As such, a stochastic model is used to account for that inherent randomness. Bettencourt's model is a truer epidemiological model in that it also accounts for this inherent randomness. Ours differs in that it does not account for a random element within the maximum likelihood model. There are arguments for inclusion of a random aspect in models describing creative processes, and arguments against. Most notably, Simonton argued that creativity in science is a constrained stochastic process, as all new theories are at least in part due to an underlying stochastic process.[7] The stochastic nature is primarily evidenced through the dual phenomena of creative productivity and multiple discoveries.[8] Other work supports this idea of stochasticity, particularly the work of Kot. Kot holds that the evolution of scientific disciplines is based upon two subsystems, of information generation and knowledge, and that it is within these subsystems that one finds stochastic processes.[9] Due to the inherent stochasticity within the subsystems, the whole must also be considered a stochastic process.[10]

However, some sociologists within the sociology of science refute these claims of stochasticity in the creative or development process. For instance, in a review of "The Sociological Study of Scientific Specialties", the work and the review hold that there are sociological processes behind the cognitive and technical developments of the

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[7] Dean Keith Simonton, "Scientific creativity as constrained stochastic behavior: The integration of product, person, and process perspectives." *Psychological bulletin* 129, no. 4 (2003): 475-494. ID: 2003-06077-003

[8] Ibid.

[9] S. Kot, "The stochastic model of evolution of scientific disciplines." *Scientometrics* 12, no. 3 (1987): 197-205.

[10] Ibid.

fields observed.[11] One of the notable factors they mention is access to graduate students, presumably because you are reaching them at a vulnerable point and can then draw them into your specialty.[12] This specific factor fits well with the variables considered in an epidemiological model, where the size of your susceptible and exposed class affects your ability to spread. Most econometric literature also supports the idea of creativity and scientific development as a non-stochastic process that is dependent solely on the independent variables included. Overall, there is a division in perspective between the humanities and the physical sciences as to the importance of randomness in the creative process. The humanities and social sciences tend to adhere to a model that forgoes the element of randomness, while the physical sciences tend to the inclusion of a stochastic element.

For our paper, we choose to not include the element of randomness, at least initially, because the maximum likelihood is first of all more suitable for an Economic audience. As a social science, we go with the prevailing understanding that knowledge creation and dissemination is inherently not a random process. As a biologist and physicist, stochastic models were suitable for Bettencourt's work, but they are hardly relevant to the field of Economics. We do however choose a maximum likelihood model for the close approximation it provides to Bettencourt's model, which we feel is a good fit for the prediction and explanation of the emergence of scientific fields.

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[11] Thomas F Gieryn, and Robert K. Merton, "Review: The Sociological Study of Scientific Specialties." *Social Studies of Science* 8, no. 2 (1978): pp. 257-261.

[12] Ibid.

CHAPTER IV

DATA

Our methodology and model draws significantly from the work of Bettencourt in “The Emergence and Development of Scientific Fields.” We begin by describing the dataset we used and the process of cleansing the data.

In Bettencourt’s work, they utilize a string search to acquire all the publications within a given field. We have the benefit of using the EconLit database, which is presorted into sub-disciplines by the editors of the database. We acquired a full copy of the publications listed in the EconLit database, with the following information for each publication: authors, year of publish, title of article, JEL codes, language of publish, and affiliations of authors. The publishers of the EconLit database kindly provided us with this information upon contact. As such, we have a dataset of about 450,000 observations, ranging from 1990 to 2011. The break at 1990 is due to the changeover to a new system of JEL coding. We attempted to cross-code work prior to 1990, but due to a lack of commonalities and consistency in the pre-1990 work, we chose to drop those observations that did not fall under the current system of JEL coding. The next step in formatting the data was pulling out the unique number of authors publishing in a given year for a given JEL code. This is in line with the methodology employed by Bettencourt, and in SEIR models in general, which requires a number of individuals in each category for each time *t*. It should be noted that papers without authors were also eliminated from the dataset, due to the obvious difficulties of inclusion. As such, we virtually eliminated all of the Y subcategory, due to the fact that it is predominantly book reviews and reports. The data was then sorted by author and year, and authors that were duplicated within a given year were dropped so as to not falsely boost the author count. To obtain the values for each year we employ a variety of count functions, which give us a unique number of authors for each category. We count all authors equally, and as a unique author for a given year. For instance, if a paper has four authors, each of those authors is counted equally within a given year of publish. JEL codes are also given equal weight. For instance, if a paper is coded with four JEL codes, it is equally represented in all four JEL categories, they are not given weight. The reason for this is because while a paper may be more representative of Agricultural Economics, with only a touch of Land Economics, the means of classification through JEL codes does not reflect this delineation and importance of one over the other. As such, papers with multiple JEL codes are given equal weight in each code they represent.

In terms of breaking authors into categories of S, E, I, and R, we divide them as follows. Authors are marked as infected (I), if they are publishing in a given year. They are considered infected for as long as they publish in a given field. For illustration, if an author publishes in a given JEL code in 1991, and 1993, but not in 1992, they would still be considered infected in the intervening year, because they had not yet renounced the idea, and their publish in 1993 evidences their ongoing belief in the concept. This is relatively standard and accepted for SEIR models.

Recovered is a slightly more complex notion with ideas, because you arguably do not ever recover from an idea. While you may not exhibit symptoms in a given year you may still be an infected believer, not recovered. Thus with ideas there is the difficulty of distinguishing between true recovery and renouncement of ideas, and only latency of infection. For our work, we choose to determine the difference by only counting those as recovered who have permanently exited the field, or who are essentially “dead” within the field. Of note is the fact that we choose not to include a ‘death’ class (as is present in some epidemiological models) because the recovered class effectively encompasses the idea of death of an author. We again employ a count function to determine the last year of publish of each individual author, and the year after that they are considered recovered.

For the exposed class (E), there is little precedent for the work. We decided to count authors as exposed if they had published in the same JEL class (A, B, C), but not within the specific JEL sub-field (A10, A12, etc). Presumably if you are in a sub-field of economics you have some familiarity with the work of others in your field even if you are not a proponent of the work yourself. As such, we considered those parties exposed.

For the last classification of susceptible (S), we considered the entire academic ‘world’ as susceptible. Any authors publishing in year *t* were considered susceptible as long as they were not also in the exposed, infected, or recovered category. *N*, or the total population is represented as the sum of all categories, or S+E+I+R.

Throughout this cleansing process we also eliminated a few JEL codes. At the beginning of the process, we started with 769 JEL codes. Once the data had been cleaned and regressed, we had results for a total of 755 JEL codes. The loss was due primarily to fields where there was no authorship listed (for instance, book reviews), and thus we could not obtain counts of infected persons. There was also some secondary loss from fields that had such negligible growth that there was insufficient variance to fit the differential equations to. Out of necessity these observations were dropped as well. There were also three JEL codes that were dropped on the basis of being unable to fit parameters through iterative strings. As such, they had to be removed. In total, the loss to the data set is negligible and we believe does not significantly affect the output, particularly given the causes for dropping the majority of the JEL's. This summarizes how the data are broken out and delineated for the purposes of the model.

Through this process of cleansing and modifying the data, we obtained a final data set with four primary variables. The four primary variables, as described above, are susceptible (S), exposed (E), infected (I), and recovered (R). Table 4.1 shows a table with a brief description of each variable, and Table 4.2 shows the summary statistics of the variables. The variables are sorted by JEL code, and arranged by year for time series data.

TABLE 4.1

DESCRIPTION OF VARIABLES

Variable	Description
S (susceptible)	Number of authors who are publishing not within your given field, but who have also not been exposed to or recovered from the idea.
E (exposed)	Number of authors who are publishing within the same sub discipline (JEL letter heading), but not within a specific field.
I (infected)	Number of authors currently publishing in a given field, including authors who may have been 'latent' for a year.
R (recovered)	Number of authors who have permanently stopped publishing in a given field.

TABLE 4.2

SUMMARIZATION STATISTICS OF VARIABLES

Variable	Mean	Std. Deviation	Minimum	Maximum
S (susceptible)	97011.96	56567.24	15174	190652
E (exposed)	5920.9	5445.372	0	26670
I (infected)	135.7888	297.9459	0	3628
R (recovered)	67.39684	158.1406	0	2997

Susceptible Variable

Let us begin by discussing the susceptible (S) variable. The numbers for the susceptible population are by far the largest, because of the broadly encompassing nature of it. The JEL codes with the largest susceptible population numbers are those that are the smallest – for instance, JEL Z (Special Topics), which has 6 subsets, or JEL A (General Economics and Teaching). Both have small subsets and as such have proportionally larger S values than other JEL's that encompass more sub-fields. The S variable, while encompassing the most area has some of the least variance between individual JEL's because of the way it is calculated. Within a JEL letter field, all of the S's will be the same, due to the definition of the exposed class. The S variable also grows steadily over time, as does the range of values. Initially, the difference between the minimum and the maximum in 1991 is about 2,000. By 2010, we've seen that grown by about 11 times, to see the divergence between the minimum and maximum be closer to 25,000. The rapid spread of some fields vs. the slower spread of other fields is to account for this. On the whole, we see an increase from year to year in the susceptible population, but we do see an unexplained dip in many of the JEL's in the year 1999. We also see a slump in the 2010 data as well, presumably because the time of collection it was incomplete.

Exposed Variable

The second variable is the exposed (E) variable. In this, we see similarly large values, although not quite to the extreme as seen in the S population. Additionally, some of the phenomena we see in the S values is seen inversely here. For instance, JEL's Z and A, which have extremely large susceptible populations due to the small amount of information they encompass, now have small E values, because they contain so few sub-disciplines in their category, that it leads to a diminished value. By contrast we see large E values in groups such as the P JEL, which has an astounding 41 sub-categories. This variation in size of the JEL's also contributes to giving us a wide range of values. In the E values, only the first 3 years have zeros as minimums, and by then the population has grown enough for there to always be an exposed value. However, the spread is still diverse, with about the same spread as seen in the S values. In 1991, the difference between the minimum and the maximum is still about 2,000, and by the end of our data the difference has progressed to about 24,000. Again, this is presumably characterized by the rapid growth of some sub-fields, vs. the not so rapid growth of others.

Infected Variable

The infected class is likely the most interesting of the variables, because it directly looks at how many individuals are engaged in a given field at any one time. This is also the most immediate and simple looks at the growth, or death, of a field. For instance, B13 (History of Neoclassical Economic Theory through 1925), from 2004 onwards starts to see a decline in their field, with steadily decreasing numbers of infected individuals. Conversely, we see that C63 (Computational Techniques and Simulation Modeling), has grown from five infected individuals in 1991, to 239 by 2010 – a massive amount of growth in 20 years! Looking at infected classes provides the most interesting picture of what classes are dying or thriving throughout the period. The range of values shows that there is a wide range of the health of sub-disciplines and whether fields are dying or expanding. For every single year you see a minimum of 0, meaning that there is at least one field in every given year that has zero authors publishing in that year. The maximum values we see are initially around 250, and by 2009, they have expanded to around 3,600, showing how much some fields have grown. Some of these fields started with relatively large populations, growing from about 300 to 2,000, as in the case of O15 (Human Resources, Human Development; Income Distribution; Migration). In other cases though, such as L25 (Firm Performance: Size, Diversification, and Scope), it grew to 3,000 from 22 observations in a matter of 20 years. This rapid growth in sub-fields could be due to a variety of things. Perhaps they are particularly easy fields to enter, requiring little prior knowledge. Perhaps they are simply areas that have become of high interest in the past few years. For instance, Economic History through 1925 has seen a decline, perhaps because as we get further from 1925, we see declining interest. Conversely, topics such as business have seen an increase as interest in business management and theory has grown. These examples all provide a portrait of the diverse trends seen in the class of infected variables. Ultimately, the infected populace is the most direct portrait of the growth or death of a field.

Recovered Variable

The last variable we have is the recovered (R) population. As a variable, this is important in measuring the exit from the field, and thus the decline or death of fields. The range is similar to what we see in the infected (I) values. Every year has a minimum of zero in at least one field, and the maximum values is around 200 to begin with in 1992, and then ranges to about 2,000 in 2010. Interestingly enough, the JEL's that have a large infected populace, also in some instances have large recovered populaces as well. For instance, O15 (Human Resources; Human Development; Income Distribution; Migration) and L25 (L25 - Firm Performance: Size, Diversification, and Scope), both with large I populations, also have large R populations, meaning that not only are many people entering the field, but many people are also leaving the field. This is an interesting phenomenon where the largest fields are also seeing the largest turnover. Perhaps it is because these are fields that are easy to enter, or "gateway" fields of sorts that begin peoples publish careers before they begin to specialize in other sub-fields. Hopefully, our regression will provide some insight as to the patterns observed in the data at this point.

All of these variables are sorted both by JEL and year. As previously mentioned, we originally began with a total of 769 JEL codes, a full list of which can be found in Appendix A. They are broken down into 20 sub categories, and within those sub-categories we see an additional breakdown of between six categories and roughly 40. As mentioned before, we eliminated some JEL codes on the basis of poor data, for a total of 755 JEL codes regressed. We eliminated one entire subcategory – JEL Y - because it was largely data tables and book reviews, meaning that it did not have listed authors. The S, E, I, R values are sorted by these 755 JEL codes. They are also sorted by year, with a value for each year between 1991 and 2010, giving us a data range of 19 years. This concludes our description of our data set.

CHAPTER V

RESULTS

In this section we present the results we have obtained from our model. We have run a best fit equation on a series of four differential equations, which capture the change in susceptible, exposed, infected, and recovered populations in publish in the EconLit database. We address the limitations of this model, and then discuss the coefficients we have found, and what the significance of these parameters is. We conclude by discussing the R-squared values on these coefficients and the significance of these values.

Limitations of the Model

There are a few things of note in our results at this point in time. Firstly, we have a problem with serial correlation in about half of our data. We ran Durbin-Watson statistics for each JEL code, and found a Durbin-Watson value for each class within each JEL. Given our model, we find that we would have no auto-correlation if our values fall between 1.736, and 3.402. However, we do have an issue of auto-correlation, particularly within the susceptible and exposed class. Within the susceptible class, we see auto-correlation within all the JEL's. Within the exposed class, serial correlation is present in 733 of the 755 JEL's (97%). This number drops to 365 JEL's with auto-correlation in the infected class (48%), and 94 JEL's in the recovered class (8%). A full table of the Durbin-Watson statistics is available in Appendix B.

We did try controlling for serial correlation through the inclusion of a time trend variable in each of the differential equations we utilized. Unfortunately, we found that the inclusion of a time trend variable ultimately worsened the problem of serial correlation. In cases where we were already experiencing auto correlation, the inclusion of a time trend pushed the values to the extremes, giving us almost negligible values in some of the susceptible variables. In cases where we had previously not had auto correlation, it also pushed the values slightly more to the extremes (although not as severe as in the cases where auto correlation already existed), in some instances causing serial correlation where there had been none before. As such, we have chosen to discard the results of the regression including a time trend and evaluate our original results, in spite of the issues of serial correlation.

In our results, we find that when we do experience serial correlation, it is almost exclusively positive serial correlation. The values that fall outside the acceptable range of Durbin-Watson statistics are almost always lower than two, and in the case of the susceptible and exposed variables, often lower than one as well. This suggests positive serial correlation. Positive serial correlation is frequently caused by a large shock in one time period, which then has a lingering effect throughout the rest of the time series. This is plausibly the explanation in our case, particularly in the instance of the susceptible and exposed populations, which have large initial values that begin the time series. The extremely large values that set the time series then presumably have a lingering effect throughout the rest of the time series, causing an error of positive serial correlation that is most strongly noted in the susceptible and exposed populaces. Unfortunately, examining those JEL's which experienced serial correlation in the infected and recovered classes did not evidence particularly large initial values in the same way as in the susceptible and exposed classes.

Another issue with our data is the inability to constrain the parameters to positive values within our given model. Some of the parameters are feasibly negative, such as Λ , which is the exponential growth rate of N. This is plausibly a negative if a field is shrinking and we see no issue here. β is the probability and effectiveness of contact with an adopter, and arguably should not be a negative, because it means a person's promotion of an idea is actively detrimental to the field. However, upon further contemplation, it is plausible to have negative values within this parameter. It is essentially saying that an individual is hurting the field through ones active participation in it. We deem this the "bad apple" effect, where a single individual has a negative impact on their field of study. Again, we find no problem with the values in this parameter. Our next parameter however, $1/\kappa$ (standard latency time), simply cannot be negative, because it is not possible to take negative time to learn something. Therefore, when we find negative values in this parameter, we consider them as zeros. $1/\gamma$, the duration of infectious period, is also a measure of time which again makes it hard to have a negative parameter value. However, we do consider the possibility that a negative value for γ is perhaps indicative of something such as a 'gateway' field, where the time spent in publish in a given field is so short, because it is essentially a jumping off point, where people cut their teeth on the publishing process before specializing. We do again consider as zero any negative parameters found in this field, but with the recognition that perhaps negative values have significance as a signaling factor. Our last parameter ρ is the probability that an exposed person has multiple and effective contacts with other adopters. While it is arguable that you cannot have negatives for this parameter, given our earlier conclusion about "bad apples" in a field, we believe there is a similar possibility to have negative values in this parameter field. We consider negatives in this case to signal someone who is effectively a recluse or is in isolation, and as such has virtually no contact with other adopters. Therefore, the range of values on this parameter can indicate a spectrum from someone who is a hermit, to someone who is extremely sociable and gregarious, thus having multiple contacts.

With these caveats, we look at what results we have garnered from the data at this time. We choose to look at a comprehensive picture of all the JEL's examined, with the acknowledgement that serial correlation is a concern in some of results.

Observations about Susceptible Variable

The first population we examine is the susceptible. Within the susceptible equation, we utilize only two parameters, Λ, exponential growth rate of N, and β, the probability and effectiveness of contact with an adopter. For the graphical representation of the parameters observed in the susceptible equation, see Figure 5.1. A detail of the graph can be seen in Figure 5.2.

Parameters Λ vs. β

Observing our parameters graphically, we see the broadest spread in any of the equations we evaluated. There are JEL's represented in every quadrant, and while there is clustering along the positive x-axis, it is not as pronounced as in other variables. This clustering makes sense, as one would assume that in the instances where there is positive effectiveness of contact with an adopter, there are also positive growth rates, as positive interpersonal connections help drive the expansion of the field. It is also interesting to see which JEL codes fall within the second quadrant. These values are a bit of an anomaly, as we have a positive coefficient for the effectiveness of contact with an adopter, and yet in spite of those positive interactions, we still see declining growth in the susceptible population. In some ways, this seems paradoxical. Those fields with persuasive individuals should see the most growth, not decline. However, it is arguable that some fields are simply dying out, and a negative growth rate exemplifies this. Those JEL's in Quadrant II are simply those that are lucky enough to have individuals so persuasive enough as to be keeping the field publicized in spite of the negative growth rates. Therefore, we speculate that JEL's in the second quadrant are actually evidence of particularly charismatic individuals in publish. Quadrant III is relatively self-explanatory. With negative growth rates and negative coefficients on the persuasiveness of adopters, it is evident that Quadrant III encompasses fields that are not only dying but whose death is being hastened along by 'bad apples' in their fields. The fourth quadrant again presents an interesting juxtaposition. We see positive growth rates, but negative coefficients on persuasiveness of adopters. This is effectively capturing the bad apple effect. Those fields in the fourth quadrant are being actively hurt by individuals, in spite of the fact that the field holds positive growth rates.

The distribution of JEL's is interesting to observe as well. We see no single JEL sequestered in only one quadrant. We do see clustering of certain JEL's though. For instance the 'L' JEL (Industrial Organization) is more heavily represented on the negative side of the x-axis, although not exclusively. By contrast, the ‘P’ JEL (Economic Systems) is almost exclusively clustered on the positive side of the x-axis. This suggests that many aspects of Industrial Organization as an academic field are slowly dying out, in many cases aided by weak authors in the field, while Economic Systems, even in the case of weak authors, is expanding. Similarly, we see a broad distribution along the y-axis, but with some clustering. For instance, the ‘G’ JEL (Financial Economics), is never negative on the y-axis, even in the cases where it holds a negative growth rate. This implies that those individuals publishing in Financial Economics are persuasive and charming enough to be effectively recruiting, even when the field itself is stagnating.

Overall, we see no definite trend or asymptote in the susceptible coefficients. There is some clustering around the origin, and particularly along the positive x-axis, but we see a much less concentrated spread than in the parameters of the other equations

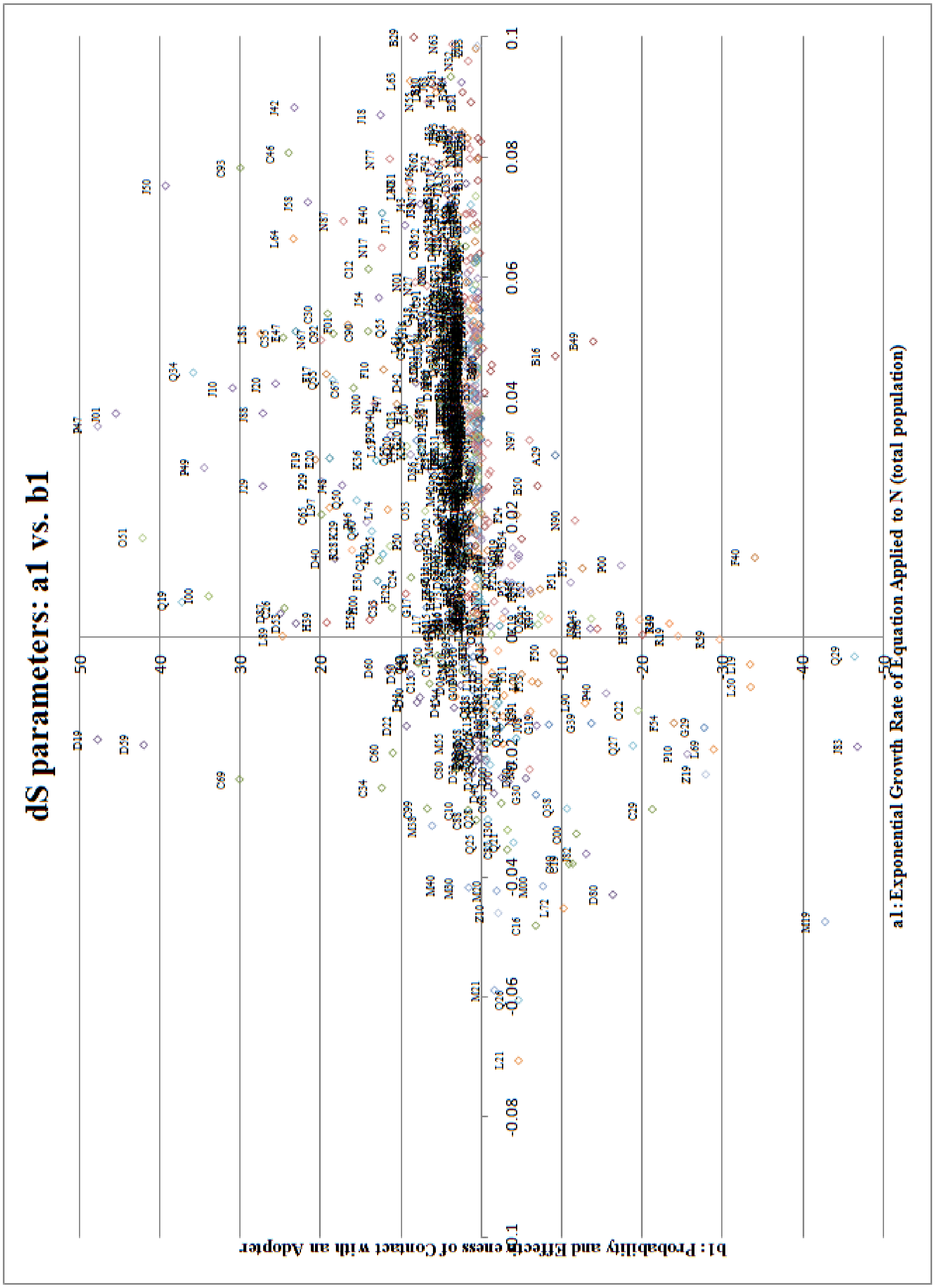
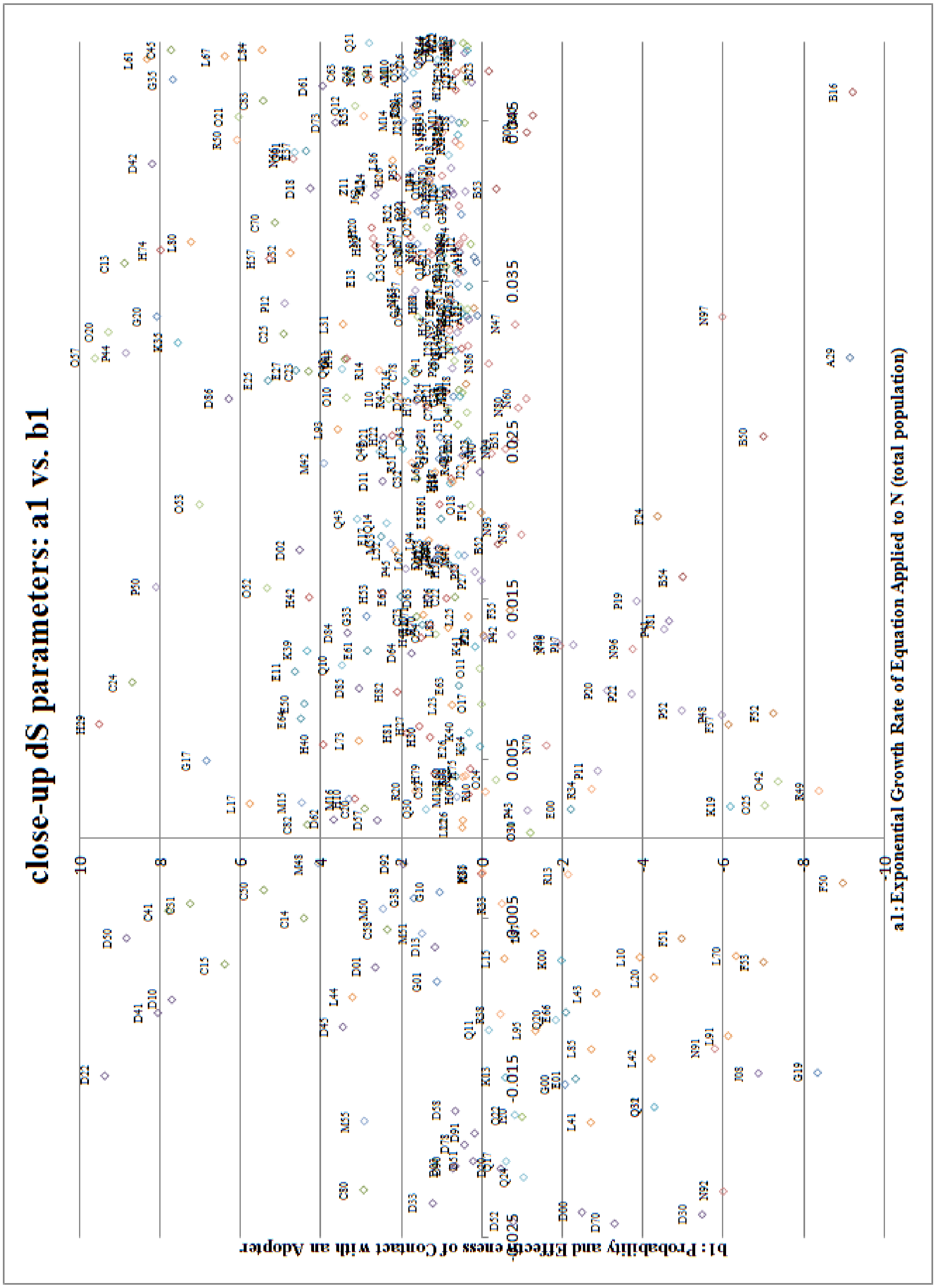

dS parameters: a1 vs. b1
a1: Exponential Growth Rate of Equation Applied to N (total population)
b1: Probability and Effectiveness of Contact with an Adopter

FIGURE 5.1

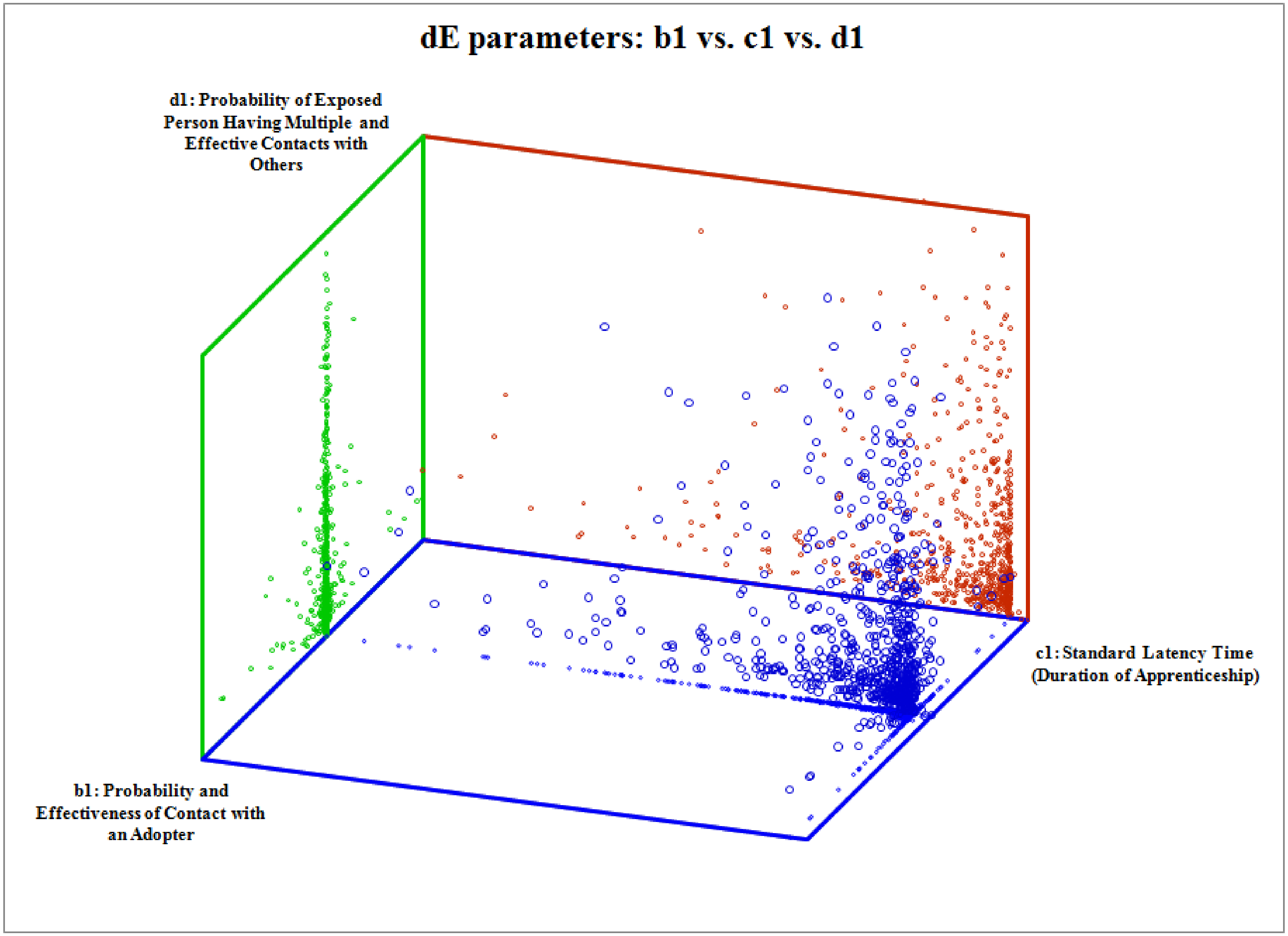
FIGURE 5.2


close-up dS parameters: a1 vs. b1
a1: Exponential Growth Rate of Equation Applied to N (total population)
b1: Probability and Effectiveness of Contact with an Adopter

Observations about Exposed Variable

The second variable we examine is the exposed population. In this equation we utilize three parameters: β, the probability and effectiveness of contact with an adopter; $1/\kappa$, the standard latency time, which in this case translates to the duration of apprenticeship; and ρ, the probability that an exposed person has multiple and effective contacts with other adopters. Again, we find it simplest to present these parameters graphically. A three-dimensional graph with all three parameters can be found in Figure 5.3; a graph comparing β and κ can be seen in Figure 5.4 and a detail in Figure 5.5; a graph comparing β and ρ in Figure 5.6 and a magnification in 5.7; and finally a graph of κ and ρ in Figure 5.8. and a detail in Figure 5.9. Looking at our three-dimensional graphs, we see our coefficients are strongly clustered around the corners and the axis of the charts. We see asymptotes of sorts in the data as well. The further along the axis we move, the less dispersion we see, and the data points become more tightly fit to the axes. For comparison sake, we examine the two-dimensional graphs, in order to better summarize the trends of coefficients.

FIGURE 5.3


dE parameters: b1 vs. c1 vs. d1
d1: Probability of Exposed Person Having Multiple and Effective Contacts with Others
c1: Standard Latency Time (Duration of Apprenticeship)
b1: Probability and Effectiveness of Contact with an Adopter

Parameters β vs. κ

We begin by looking at the β and κ graph, comparing probability and effectiveness of contact with an adopter with standard latency time. In this graph we see a horizontal asymptote along the y-axis as the points converge towards the left. The majority of the points are clustered above the x-axis, which means that in most cases, authors are effective proponents of their fields. There are however, a significant number who fall below the x-axis, and thus into the ‘bad apple’ category. The interplay of this with apprenticeship time seems to be relatively little. Of note with this graph is that the majority of the coefficients for κ are negative, in spite of the determination that you cannot in fact have negative values. As such, we consider those that are negative to have been put to zero. Given the large amount of values that will thus be regarded as zero, we essentially see no difference in the apprenticeship times for the majority of sub-fields. As previously discussed, apprenticeship time is indirectly a measure of complexity of material. Given the relative sameness of the coefficients for apprenticeship time, we can thus conclude that the complexity of material is relatively homogenous across Economic subfields. At the very least, the differences in complexity of material are negligible enough as to not inform how long it takes to master material. Given the negligible or zero values for κ, the pattern of the β coefficient is most salient and explanatory in this graph, and shows evidence of sub-disciplines where there are “bad apples” in the field.

There are a few exceptions to the negligible κ values, notably some with positive coefficients from the ‘C’ JEL (Mathematical and Quantitative Mehthods), including C01 (Econometrics), and C46 (Econometric and Statistical Methods: Specific

Distributions; Specific Statistics). This positive coefficient indicates that the standard latency time, or in the case of our model apprenticeship time is longer. As such, it would seem that these few specific sub-fields have more complex content and thus take longer to achieve mastery of. One interesting note on the relationship between β and κ is that there are no instances where you have a positive coefficient for apprenticeship duration, and a negative coefficient for probability and effectiveness of contact with an adopter. This is presumably because if a field takes much longer to learn, you don't want to be stuck working with someone who is a 'bad apple' for that extended period of time. Conversely, there is the possibility that the 'bad apples' are driving away those who would be willing to commit to a longer field of study. We do see some clustering of the β coefficients under the x-axis in the 'P' JEL (Economic Systems), suggesting that this field has more individuals who are deemed "bad apples" than other fields.

In general, we see a strong trend in the data, with a horizontal asymptote along the y-axis, although it is surprising to see the large number of negative coefficients for latency times.

FIGURE 5.4

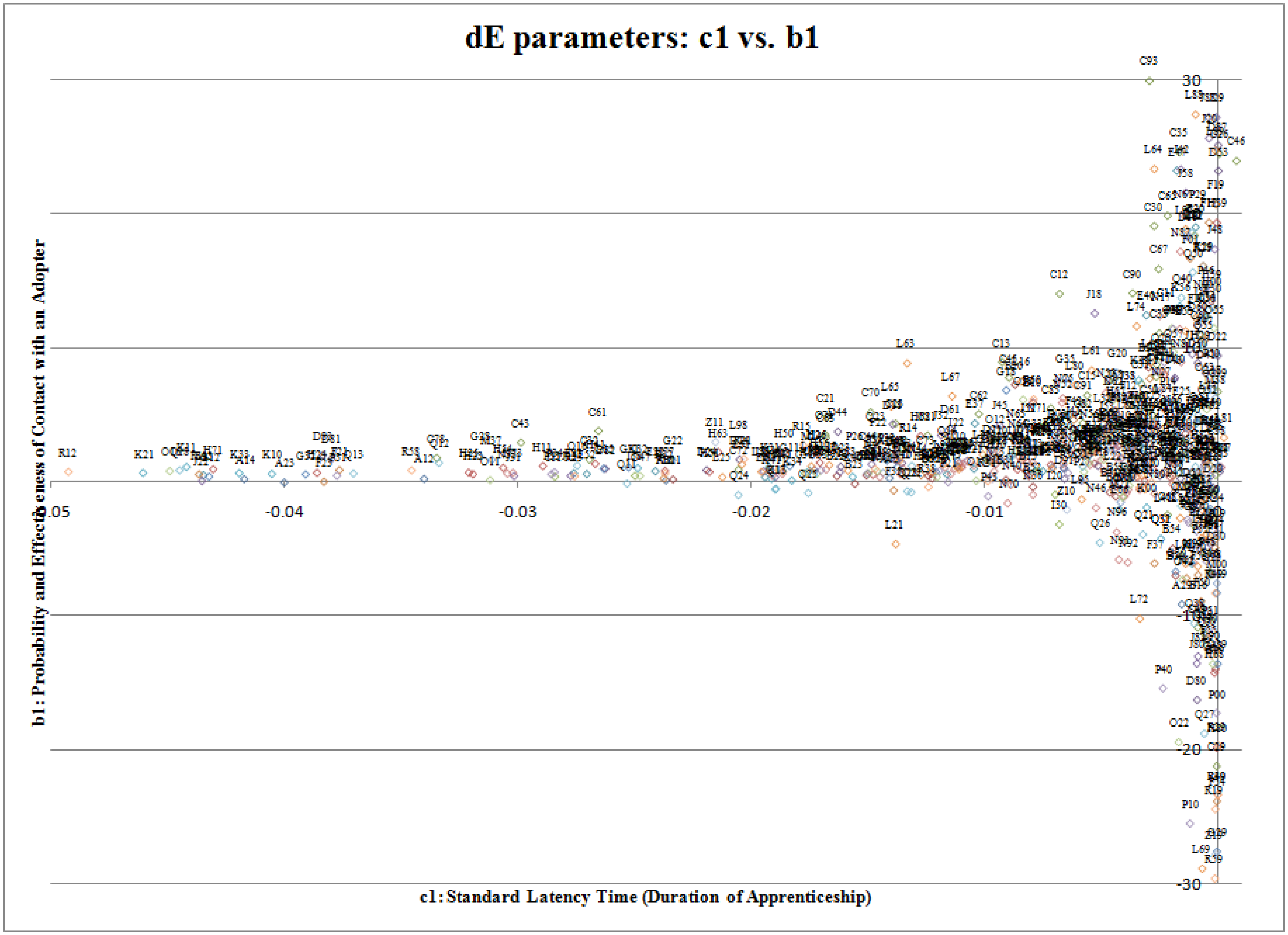
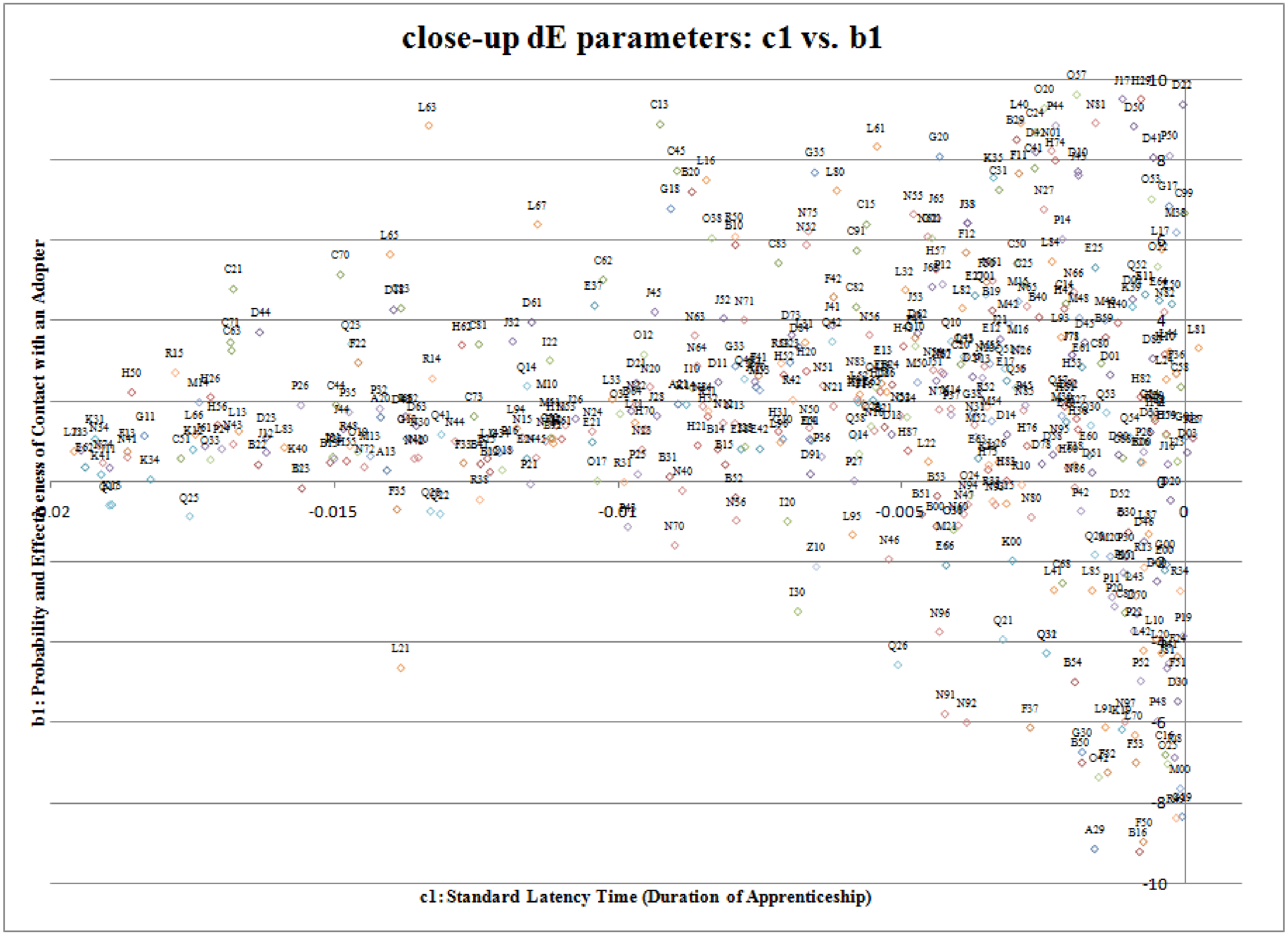

dE parameters: c1 vs. b1
b1: Probability and Effectiveness of Contact with an Adopter
c1: Standard Latency Time (Duration of Apprenticeship)
30
-10
-20
-30
-0.05
-0.04
-0.03
-0.02
-0.01

FIGURE 5.5


close-up dE parameters: c1 vs. b1
b1: Probability and Effectiveness of Contact with an Adopter
c1: Standard Latency Time (Duration of Apprenticeship)
-0.02
-0.015
-0.01
-0.005
0
10
8
6
4
2
0
-2
-4
-6
-8
-10

Parameters β vs. ρ

The next graph we examine compares the parameters ρ, the probability that an exposed person has multiple and effective contacts with other adopters, and β, the probability and effectiveness of contact with an adopter. We again see clustering similar to what we noted when comparing β and κ. In this instance however, when we previously saw κ as having almost exclusively negative coefficients, we see now that ρ is almost exclusively positive. Presumably the lower end of the scale suggests that an individual is more reclusive, and is thus likely to have fewer effective contacts. The higher end of the scale conversely suggests an individual who is very sociable and is thus likely to be contacting many individuals. The lack of negatives suggests that there are virtually no economists practicing in complete isolation on desert islands – or if so, they are not contributing to the greater Economics community. Besides being virtually bounded at 0, we also see an vague horizontal asymptote along the y-axis, similar to our previous graph. It is not as defined as in the β and κ graph, but as you move further along the y-axis, the clustering disperses less from the axis. The data is clustered in the first and fourth quadrants. Quadrant I, with a positive β value, and positive ρ value, indicates individuals who are both sociable and are having positive contacts with adopters. Quadrant IV conversely, with a negative β value, is individuals who are sociable but are "bad apples". Theoretically, a negative value of β with a high ρ value could be significantly detrimental to your field because you are having so many contacts.

There is less of a pattern in these two quadrants than in previous graphs, but we still see some clustering by JEL. For example, we see a larger component of 'K' JEL's

(Law and Economics) towards the larger end of the ρ scale. This essentially says that authors in those fields are more likely to have effective contacts, presumably because of their sociability and outreach to others. This is true even of the few ‘K’ JEL’s in the fourth quadrant, where even though they may be driving people away from their field, are still highly effective at outreach. We see a large clustering of ‘N’ JEL’s (Economic History) along the higher end of the scale as well, although a significant portion of them are below the x-axis, suggesting they are ‘bad apples’ who are reaching out.

Overall, these parameters exhibit similar behavior as to the one’s previously observed, with bounding at zero, and asymptotes along a single axis.

FIGURE 5.6

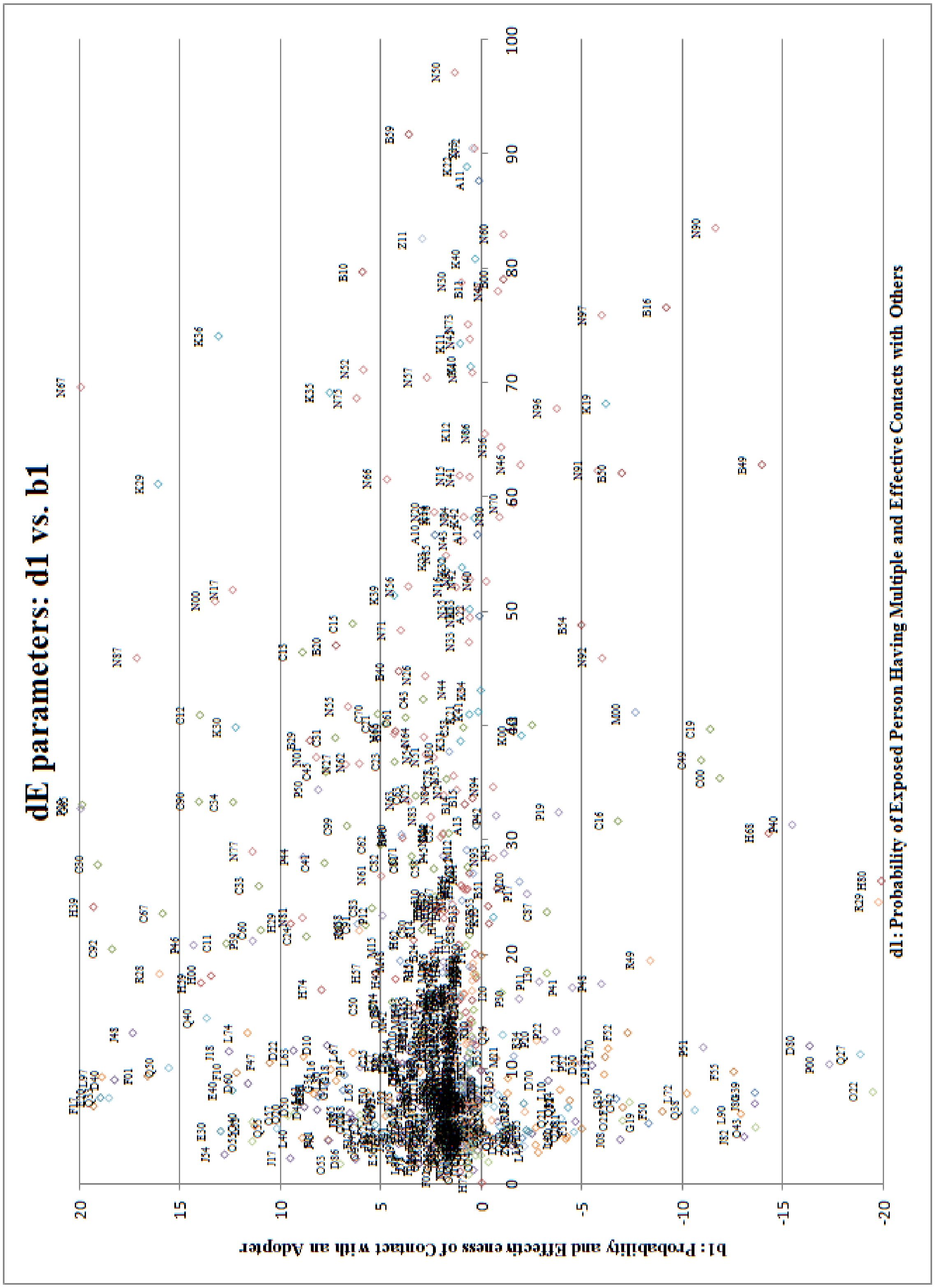
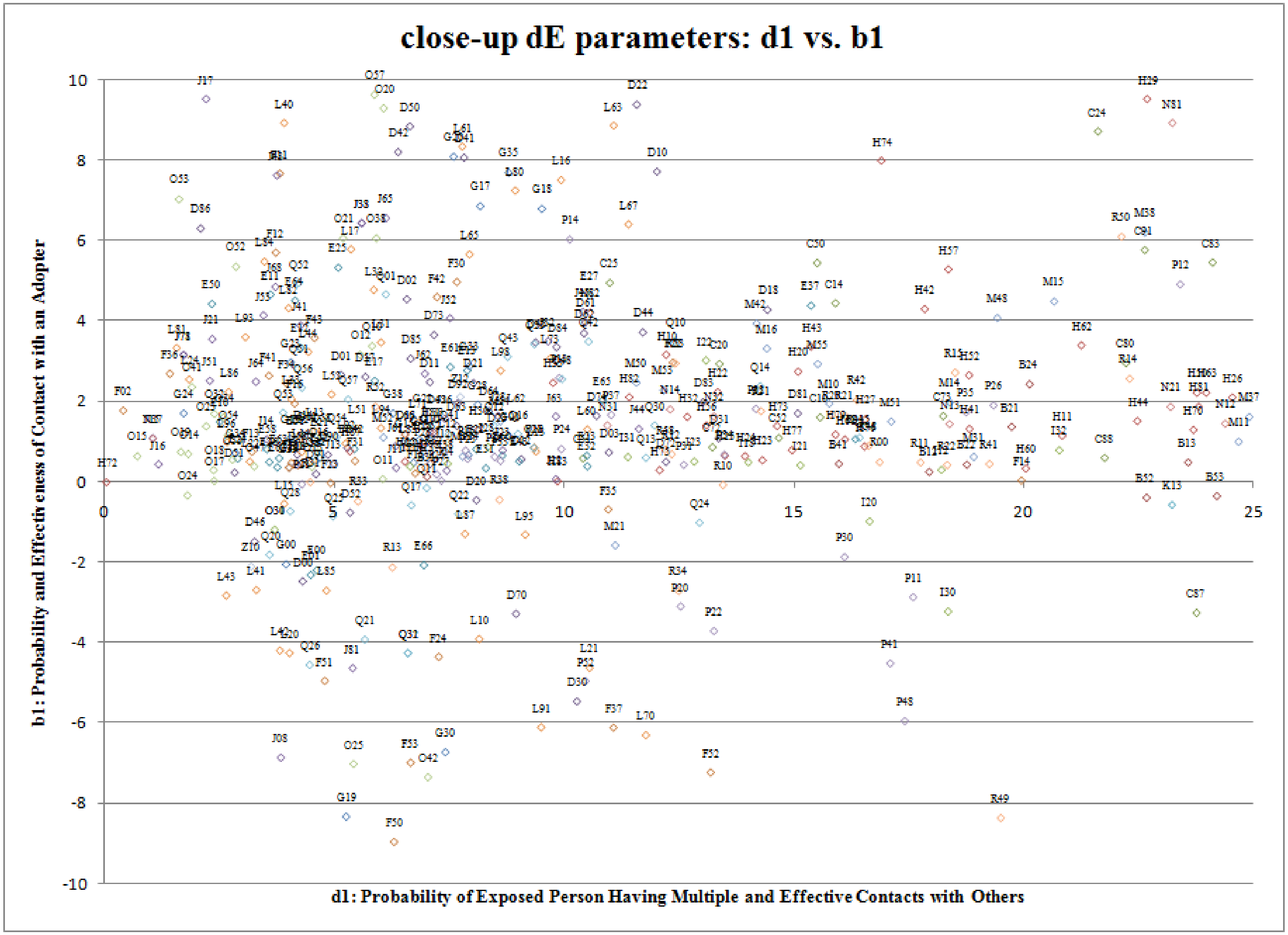

dE parameters: d1 vs. b1
d1: Probability of Exposed Person Having Multiple and Effective Contacts with Others
b1: Probability and Effectiveness of Contact with an Adopter
0
10
20
30
40
50
60
70
80
90
100
20
15
10
5
0
-5
-10
-15
-20

FIGURE 5.7


close-up dE parameters: d1 vs. b1
b1: Probability and Effectiveness of Contact with an Adopter
d1: Probability of Exposed Person Having Multiple and Effective Contacts with Others

Parameters ρ vs. κ

The last graph we look at for the exposed population is that of κ, the duration of apprenticeship and ρ, the probability that an exposed person has multiple and effective contacts with other adopters. Like the other two graphs, we see bounding close to zero along the y-axis. As previously noted, all of the ρ values are positive, while the majority of the κ values are negative. This means that the majority of these data are centered in the fourth quadrant with a small amount stretching into the first. Given that we consider as zero any negative κ values, all of our data would be tightly clustered to the x-axis, and stretching out along the x-axis. The most clustering is near the origin, and diminishes the further down the x-axis you move. Given there is negligible difference in latency time and complexity, the determining factor when looking at these variables is the probability of effective contacts with others, or essentially sociability. We see clustering of these ρ values close to the origin, but with dispersion along the length of x-axis. It would appear there is a normal range of sociability and effective contact into which most individuals fall, and then there is a smaller segment which is more highly effective at outreach than their counterparts.

We see similar trends to what we have observed in our other two graphs describing the parameters of exposed equation. We see some ‘C’ JEL (Mathematical and Quantitative Methods) clustering above the x-axis, indicating a positive latency time, and thus more complex knowledge. We again note clustering among the higher ρ values of the ‘N’ JEL (Economic History), again suggesting that Economic Historians are particularly sociable as a sub-discipline.

Ultimately, we find that given the large number of negative values of κ, apprenticeship time is negligible across almost all JEL's. Given these values are considered zero, the relationship between the probability that an exposed person has multiple and effective contacts with other adopters, and the probability and effectiveness of contact with an adopter is the most relevant of the graphs to explaining the exposed population. As such, the coefficients of ρ and β becomes the most salient in explaining our exposed populace.

FIGURE 5.8

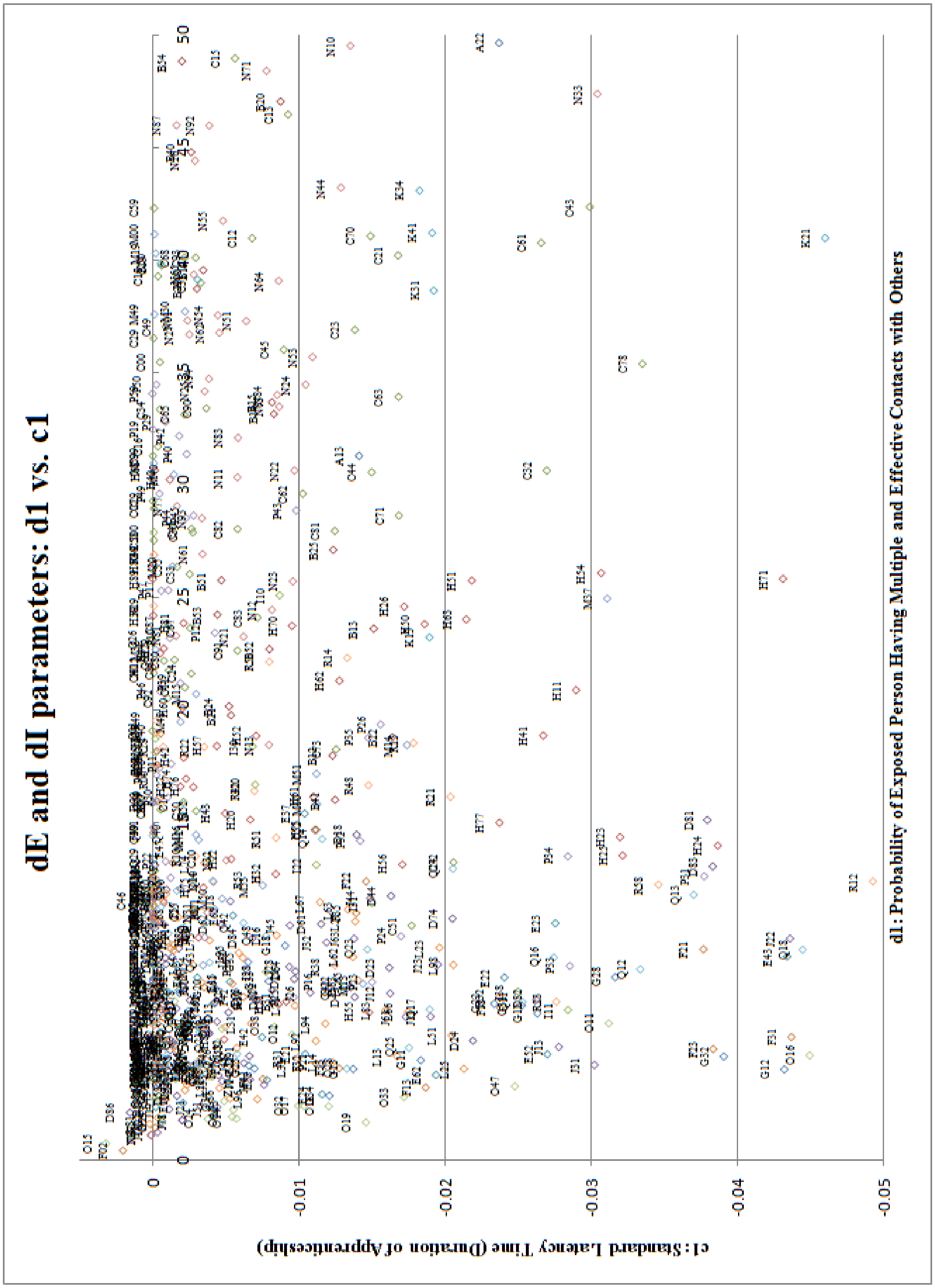
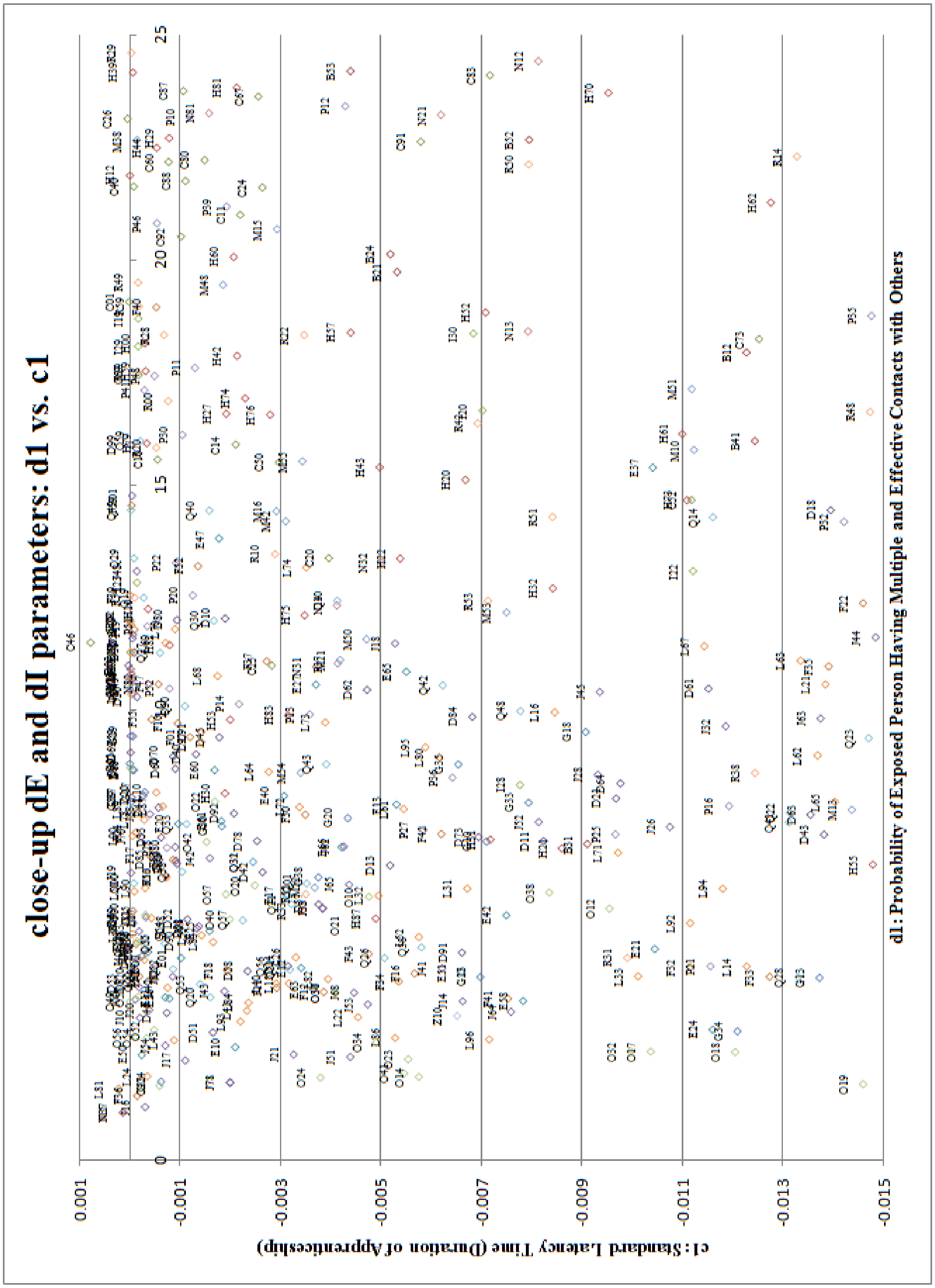

dE and dI parameters: d1 vs. c1
0
5
10
15
20
25
30
35
40
45
50
0
-0.01
-0.02
-0.03
-0.04
-0.05
c1: Standard Latency Time (Duration of Apprenticeship)
d1: Probability of Exposed Person Having Multiple and Effective Contacts with Others

FIGURE 5.9

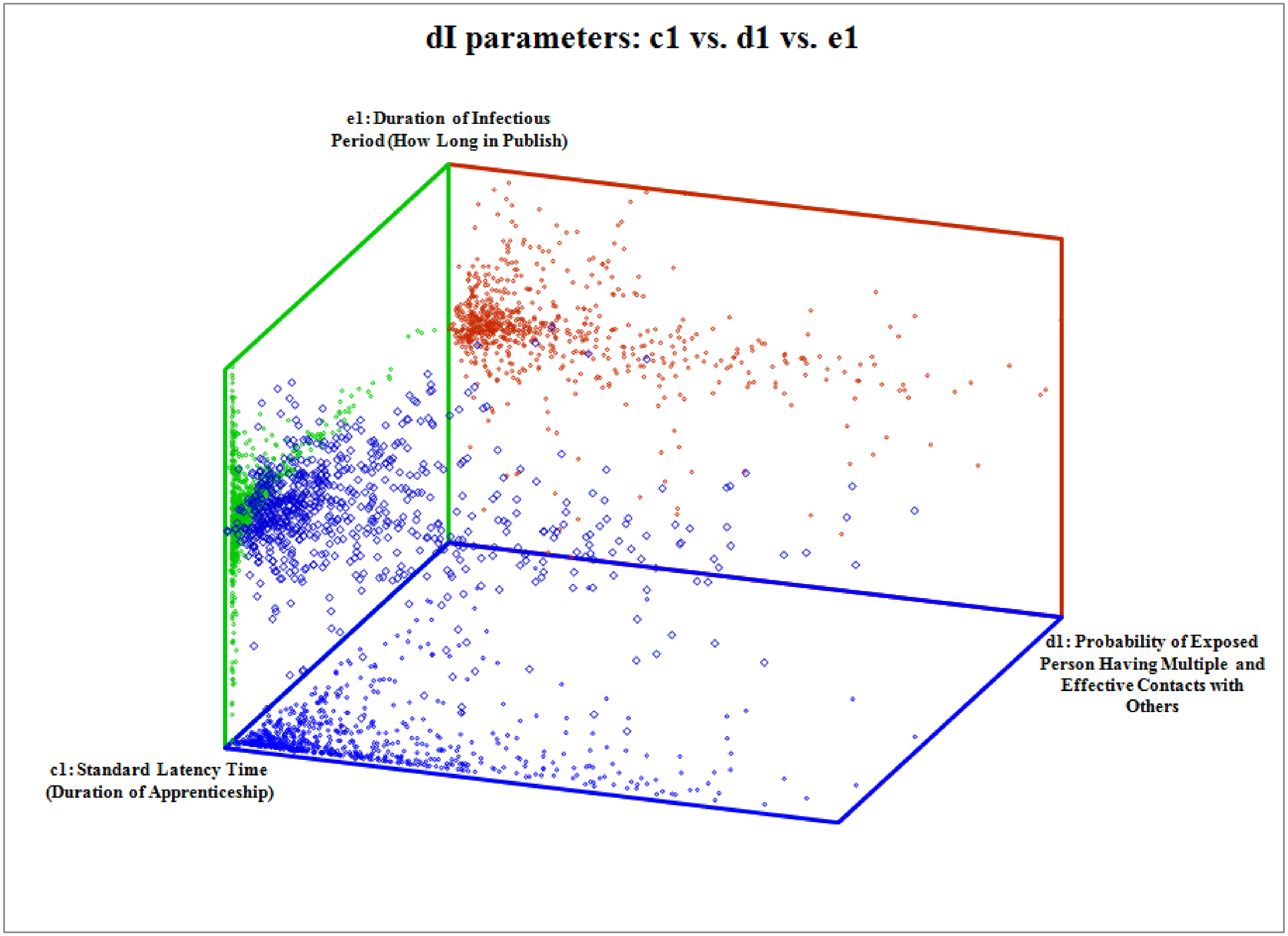

close-up dE and dI parameters: d1 vs. c1
d1: Probability of Exposed Person Having Multiple and Effective Contacts with Others
c1: Standard Latency Time (Duration of Apprenticeship)
0
15
20
25
0.001
-0.001
-0.003
-0.005
-0.007
-0.009
-0.011
-0.013
-0.015

Observations about Infected Variable

We now look at our infected populace, which is arguably one of the most fascinating equations because it is the most direct measure of the growth, or death, of an academic sub-discipline. In our infected equation we have three parameters: κ, the standard latency time, considered to be the duration of apprenticeship; γ, the duration of the infectious period, which in this case translates to how long one publishes on the topic; and ρ, the probability that an exposed person has multiple and effective contacts with other adopters. All of our graphs for this equation can be found in the following figures: A three-dimensional model with all three parameters can be seen in Figure 5.10. This is complemented by the comparison of our two-dimension models, with a graph of ρ and κ that can be referenced previously in Figure 5.8, with a detail in Figure 5.9. A comparison of κ and γ is seen in Figure 5.11, followed by a detail in Figure 5.12. Lastly, we have a comparison of γ and ρ in Figure 5.13, concluded with a detail in Figure 5.14.

We begin with a brief look at our three-dimensional plot of all of the parameters. We see again a concentration of our coefficients along the axes and the corners of our graph, although there is slightly more diffusion from the axes than seen in Figure 5.3. In contrast there is a heavier concentration in the corners of the graph. Again, we look at the two-dimensional graphs to get a more complete portrait of the relationship between parameters.

FIGURE 5.10


dI parameters: c1 vs. d1 vs. e1
e1: Duration of Infectious Period (How Long in Publish)
d1: Probability of Exposed Person Having Multiple and Effective Contacts with Others
c1: Standard Latency Time (Duration of Apprenticeship)

Parameters ρ vs. κ

We begin by looking at parameters ρ, the probability that an exposed person has multiple and effective contacts with other adopters and κ, standard latency time. We have seen this pair of parameters in the exposed variable as well, and we see the same results as previously observed. To summarize, we see bounding close to zero along the y-axis with all of the ρ values being positive, and with the majority of the κ values being negative. Again, this means most of our data is in Quadrant IV, with a small spillover to the Quadrant I, and tight clustering along the x-axis, particularly near the origin. Negative κ values are considered as zero, ultimately meaning there is negligible difference in latency time, and thus, the factor of note is the probability of effective contacts with others - sociability. We again note the clustering near the origin, suggesting that most individuals fall into a median range of effectiveness in contact. The same clustering as before is present, suggesting that those in 'N' JEL (Economic History) are particularly gregarious.

Parameters κ vs. γ

We now examine the relationship between our parameters κ, standard latency time, and γ, duration of publish. In this graph we see an interesting shape again. We see bounding near zero along the y-axis, again driven by the almost exclusively negative values of κ. However, we have a large range of γ values, with both a positive and negative populace. Presumably, a negative coefficient for γ means that individuals are not spending a significant amount of time publishing in your field – the field is an entry point into the world of research, but not one that people inhabit for long, as they then move on to a specialty. Looking at the spread of positive γ values, we see that along the y-axis they reach fairly high, with a vertical asymptote along the x-axis. This diffusion up the y-axis can be explained by the complexity of sub-disciplines. In the instances where we see positive κ values, it implies a more complex field and thus more time for mastery. As such, should you be in such a field, you would be less willing to exit, because of the time it took to gain admittance. As such, we see this stretching up the y-axis as we approach the origin.

In terms of which JEL's we see spiking positively, there is no definite trend. Looking at the values that are negative, there is no distinct pattern of what JEL's fall into the 'gateway' category. There is decent representation of JEL's ending in zero, which denotes a "General" sub-category, but it is by no means exclusive. There is a slight predominance of 'L' JEL (Industrial Organization), and 'K' JEL (Economics and Law), suggesting that these two sub-disciplines attract career authors, as opposed to hobbyists, but it is again by no means exclusive.

Overall, we see that the majority of the coefficients fall in Quadrant II, meaning that in most cases, specialization is pursued as a long term option. Individuals do not join a specific sub-field for a short period of time. The length of their stay does vary, and there are fields that exhibit a longer staying power, but it is not by any means exclusive to a specific sub-discipline. There are some with negative values, and these are presumed to be 'gateway' fields, in which people are first introduced to the publishing process before they have specialized. There is no specific trend among these fields, other than a slight inclination towards the JEL codes that are "General", but again, this is not exclusive.

FIGURE 5.11

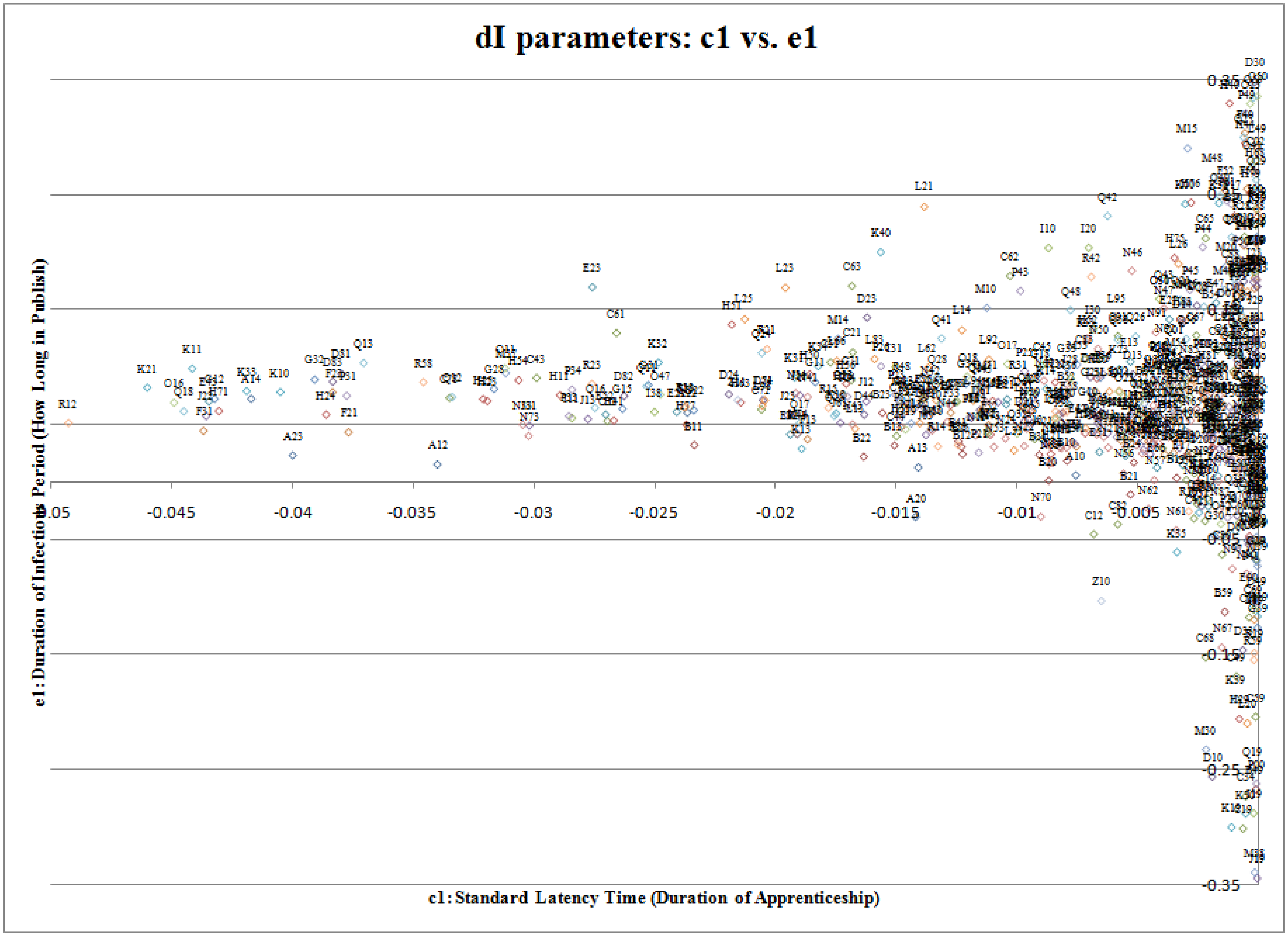
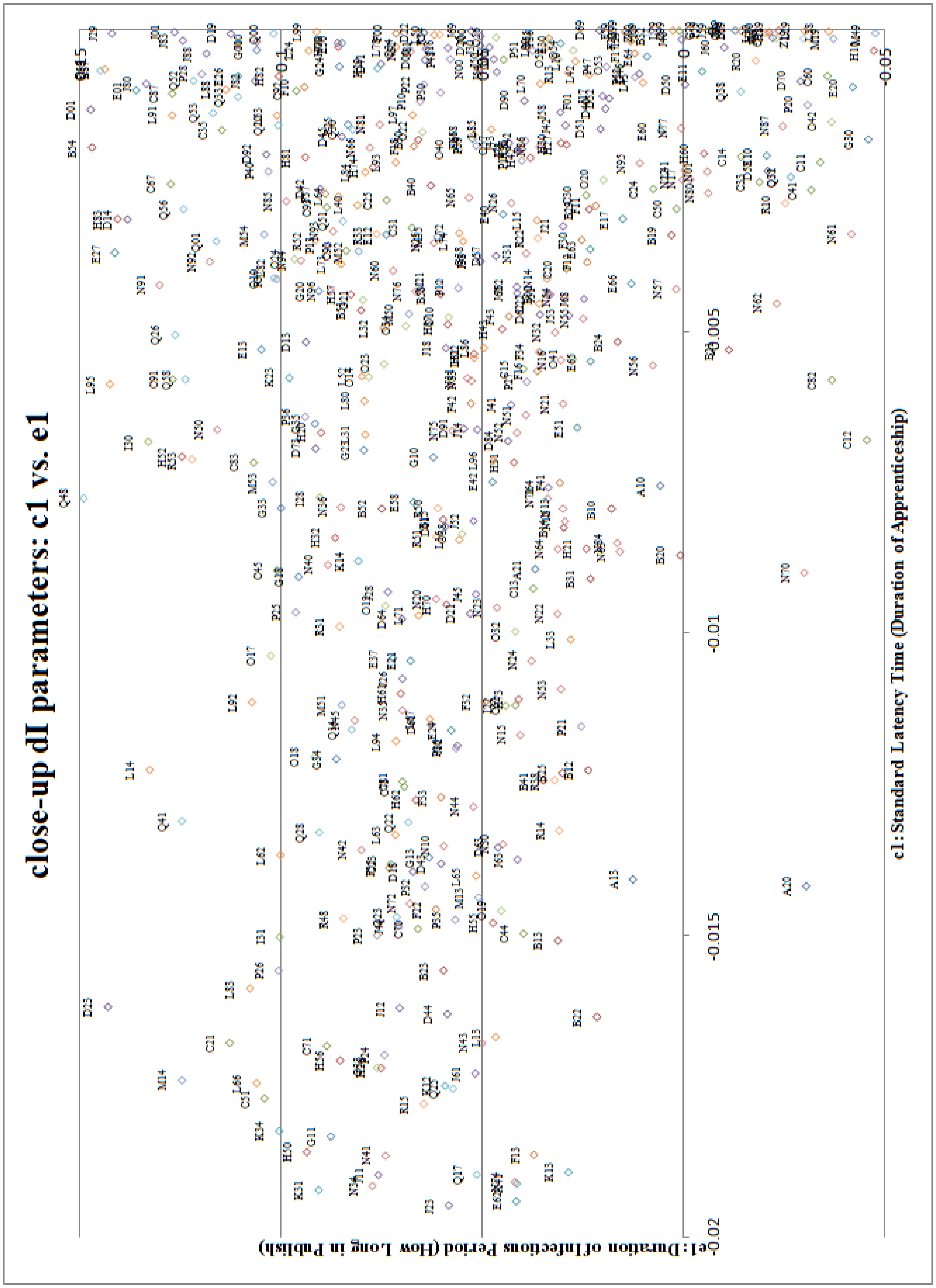

dI parameters: c1 vs. e1
e1: Duration of Infectious Period (How Long in Publish)
c1: Standard Latency Time (Duration of Apprenticeship)
-0.045
-0.04
-0.035
-0.03
-0.025
-0.02
-0.015
-0.01
-0.005
0.05
-0.15
-0.25
-0.35

FIGURE 5.12


close-up dI parameters: c1 vs. e1
c1: Standard Latency Time (Duration of Apprenticeship)
e1: Duration of Infectious Period (How Long in Publish)
-0.02
-0.015
-0.01
-0.005
0
-0.05
-0.1
-0.15

Parameters ρ vs. γ

We conclude our examination of the parameters describing the infected population by looking at a graph of γ, duration of infectious period, and ρ, probability of effectiveness of contact. The graph here is slightly more dispersed than we have seen in other pairs of parameters. The graph is localized in the first and fourth quadrants, as all of the ρ values are positives. However, we again see a wide spread of γ values. We do not see a clear asymptote, although as you move further along the x-axis, you see tighter clustering to the axis, although only on the positive side. The negative side experiences roughly the same diffusion, which suggests that regardless of how sociable an individual may be, if a field is a 'gateway' field, the individuals in it have little effect on convincing others to stay. Theoretically, location within Quadrant I means that you are not only a staying presence in your field, but you are also some degree of sociable, depending upon where you fall on the x-axis. Location in the fourth quadrant by contrast, means that your field is a 'gateway' field, again, with varying degrees of sociability.

Unfortunately, we do not see any distinct trending in the JEL's in this graph. There is very minimal clustering of JEL's around the axis or towards one end of the distribution, but it is not conclusive enough to say anything about an entire field.

FIGURE 5.13

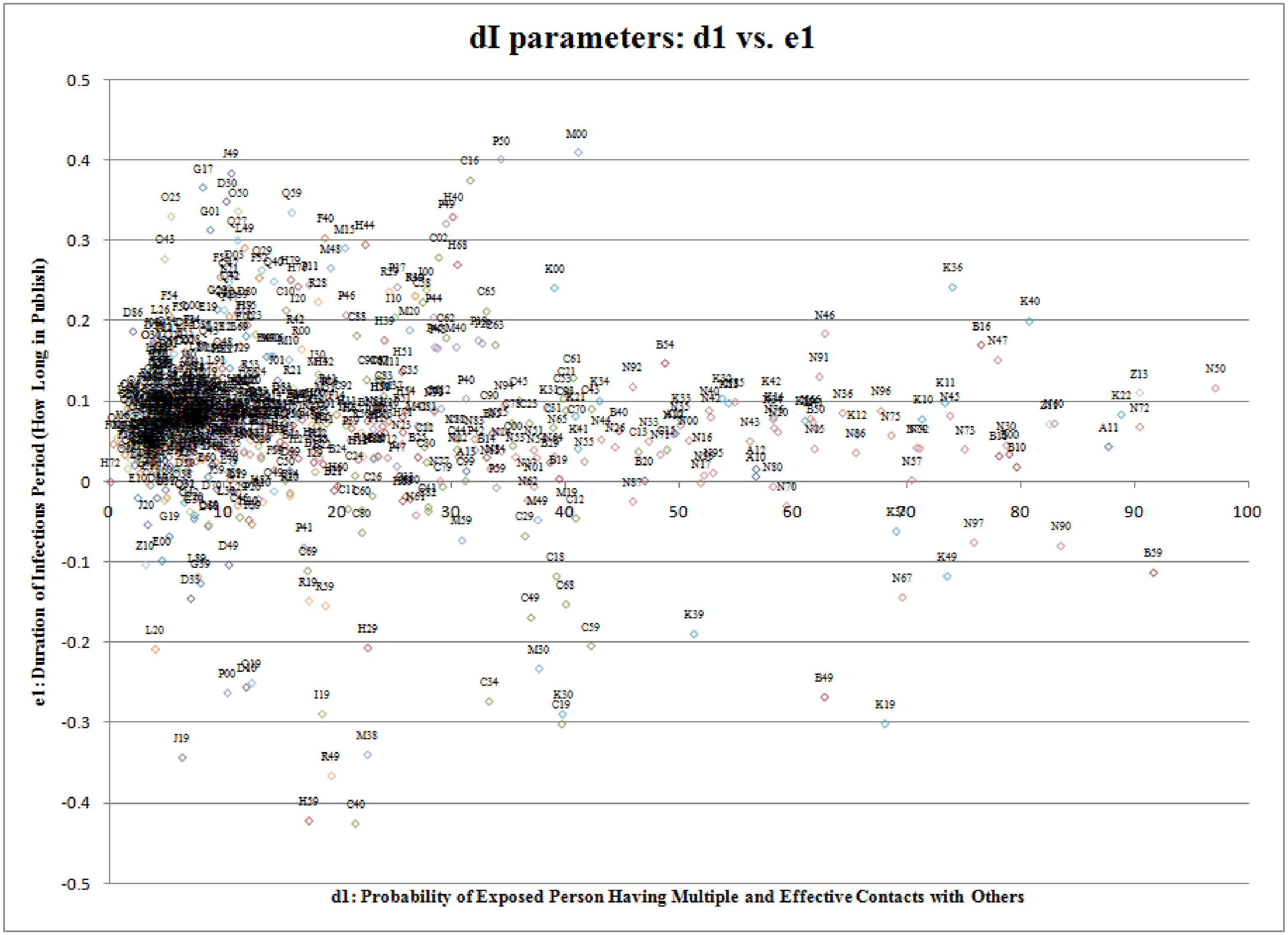
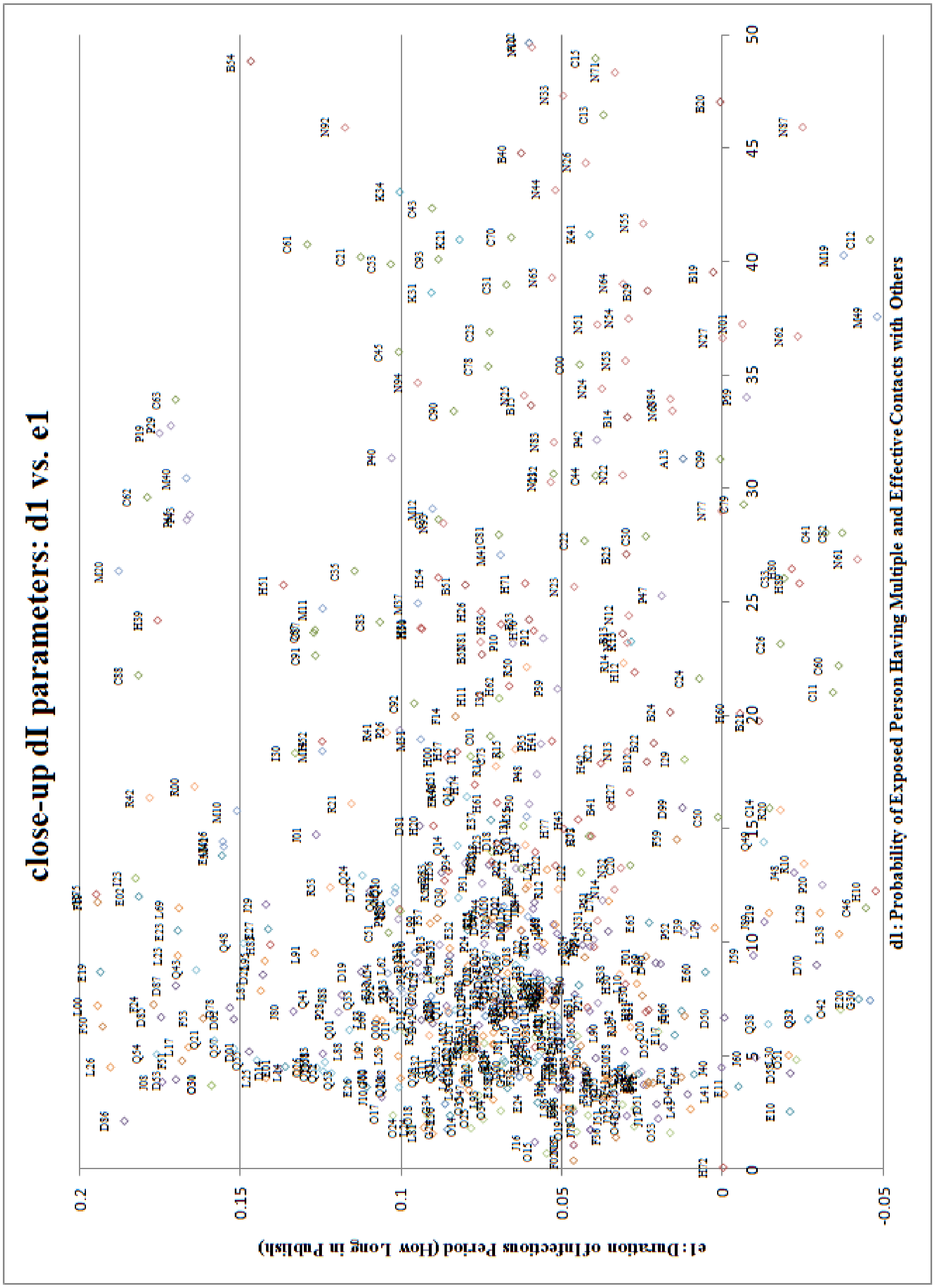

dI parameters: d1 vs. e1
e1: Duration of Infectious Period (How Long in Publish)
d1: Probability of Exposed Person Having Multiple and Effective Contacts with Others

FIGURE 5.14


close-up dI parameters: d1 vs. e1
e1: Duration of Infectious Period (How Long in Publish)
d1: Probability of Exposed Person Having Multiple and Effective Contacts with Others
0.2
0.15
0.1
0.05
0
-0.05
0
5
10
15
20
25
30
35
40
45
50

Observations about Recovered Variable

The last variable we examine is the recovered class. The recovered class, unlike the other three we have examined, has only one parameter: γ, duration of infectious period. For these results, we graph just the γ coefficients along the y-axis, which can be seen in Figure 5.15, and a detail in Figure 5.16.

Parameter γ

There is a wide range of γ values represented in the graph. We have both negative and positive values, and while we experience some clustering, there is a wide dispersion. There is some heavy clustering near the origin, but there is also fairly significant diffusion along the y-axis as well, suggesting that the length of time one stays in a field can widely vary. We do see some negative values, suggesting gateway fields again. The majority of the values are positive, and are clustered within a [0, 0.1] range, suggesting that there is a relatively standard length of time one is working in a field. There are of course, exceptions to this, and we see a fair amount of points that are higher, suggesting a longer career. In this case as well, we do not see significant enough clustering to draw conclusions about entire fields of JEL codes.

This concludes our evaluation of our results. Clearly, there are many more uses for these results, to draw conclusions not only on a broad level, but also on an individual sub-discipline level. We have chosen to focus on the broader implications and graphs for our results section.

FIGURE 5.15

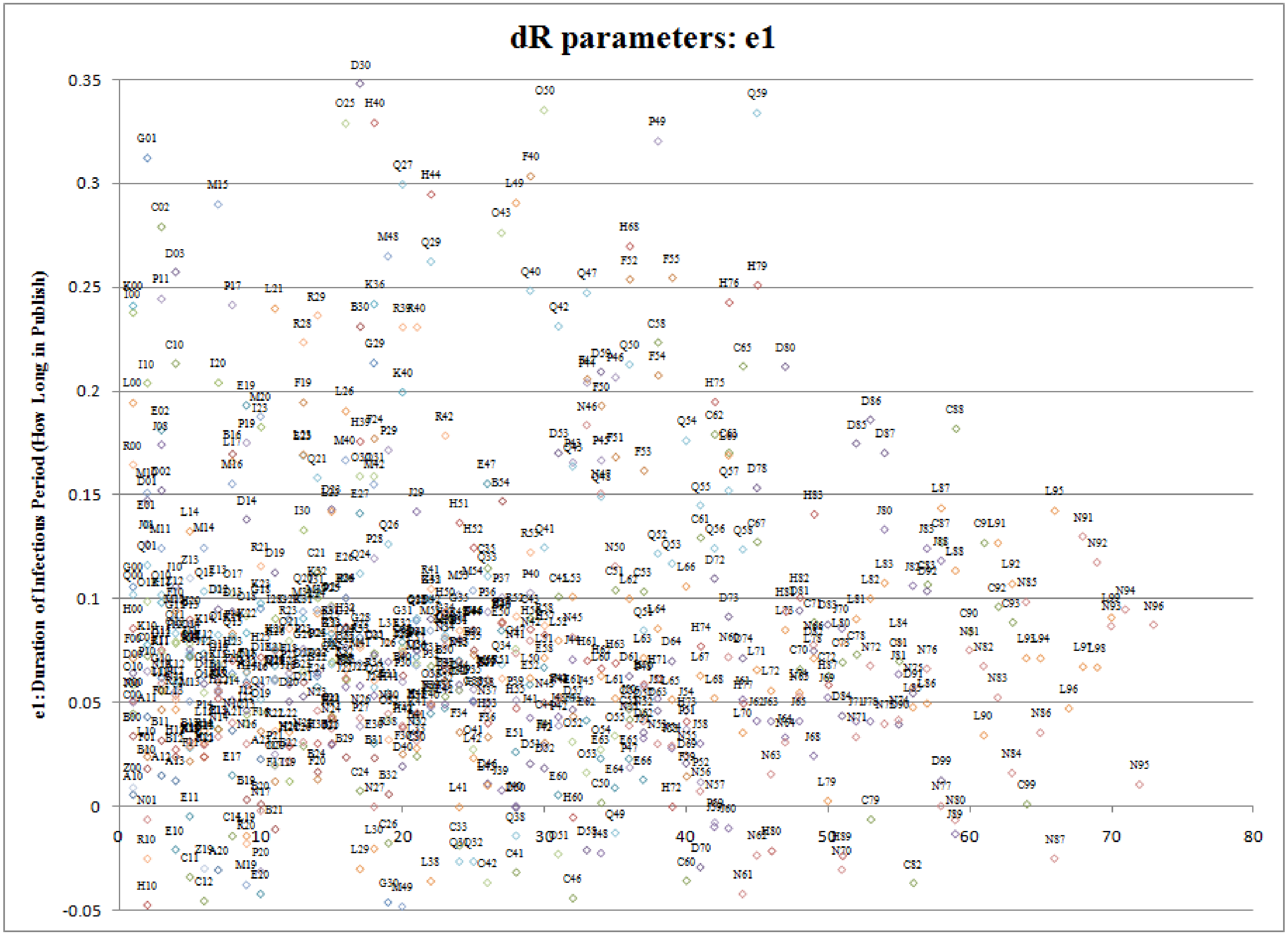
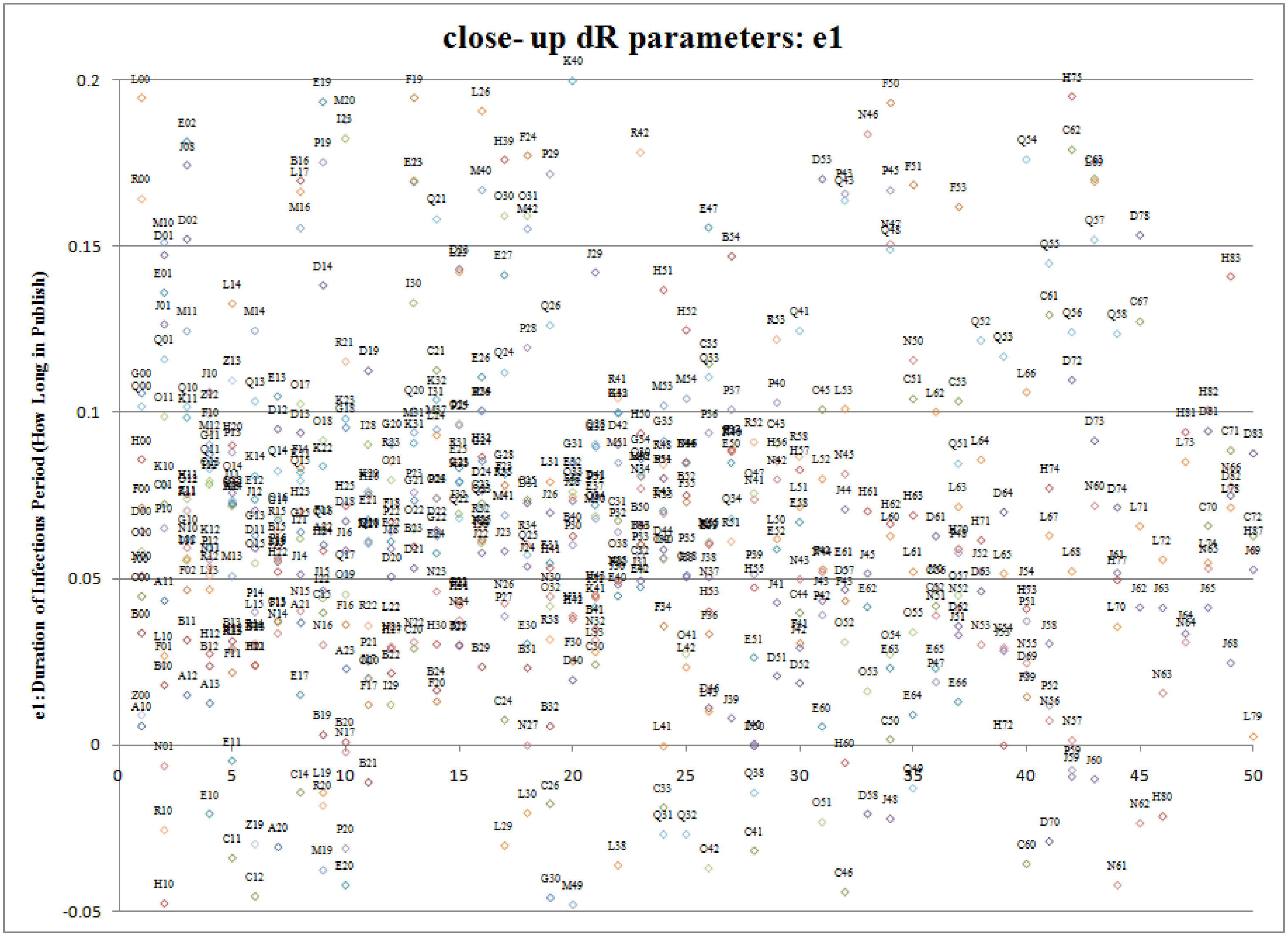

dR parameters: e1
e1: Duration of Infectious Period (How Long in Publish)
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
-0.05
0
10
20
30
40
50
60
70
80

FIGURE 5.16


close-up dR parameters: e1
e1: Duration of Infectious Period (How Long in Publish)
0.2
0.15
0.1
0.05
0
-0.05
0
5
10
15
20
25
30
35
40
45
50

Goodness of Fit

We briefly examine the R-squared values as a measure of goodness of fit of our model. Due to the fact that our model does not have a constant, our R-squared values are not bounded to the normal [0, 1] range. As such, the conclusions we can derive from them are somewhat compromised, but we still briefly address them. For the ease of this paper, we look at the averages of the R-squared value by JEL grouping (A, B, etc), but a full table of R-squared values can be found in Appendix C. Below are the averages of the R-squared values by JEL, in Table 5.1.

TABLE 5.1

AVERAGE R-SQUARED VALUES BY JEL

	JEL A	JEL B	JEL C	JEL D	JEL E	JEL F	JEL G	JEL H	JEL I	JEL J
dS R-sq	0.05469	0.00755	-0.0114	-0.0161	0.03795	0.0164	0.01785	0.03812	0.02534	0.02885
dE R-sq	0.00884	0.01182	0.07631	0.05525	0.03318	0.0099	0.0577	0.04386	0.02569	0.03579
dI R-sq	0.32666	0.34163	0.14769	0.02521	0.21409	0.2912	0.13991	0.28404	0.21786	0.03374
dR R-sq	0.02708	0.06408	0.12059	0.12059	0.17838	0.17436	0.31253	0.16416	0.30611	0.11815
	JEL K	JEL L	JEL M	JEL N	JEL O	JEL P	JEL Q	JEL R	JEL Z	
dS R-sq	0.03335	0.0046	-0.0492	0.03662	0.0378	0.03955	-0.0012	0.10984	-0.0905	
dE R-sq	0.01402	0.01773	0.07203	0.02654	0.02935	0.00886	-0.0347	0.13749	-0.3048	
dI R-sq	0.30921	0.24654	0.00196	0.3745	0.22608	0.25229	0.17639	0.19839	0.00957	
dR R-sq	0.11516	0.19069	0.29664	0.05462	0.2768	0.1398	0.26616	0.16638	-0.0905	

Evidently, there is a wide range of R-squared values. We see the smallest values in the dS and the dE equations, suggesting that our model was not robust at explaining the factors influencing the susceptible and exposed populations in virtually any field. However, we see much higher values in the dI and dR equations. The R-squared values for dI are the highest, with values predominantly in the [0.2, 0.3] range. This is relatively strong, and suggests that our model is relatively good at explaining factors contributing to the size of the infected population. This is also seen in the dR equations, where the R-squared values are on average close to 0.1. We see some as high as 0.3

again, but also some as low as 0.02. Overall, it suggests that our model is a decent fit for explaining the size of the recovered population. Again, we note that given that we do not have a constant, our range of R-squared values is not constrained to [0,1], and thus we cannot be assured of the goodness of fit of our model, but given the relatively higher values seen for dI and dR, we believe the model is an appropriate fit for those populaces.

In conclusion, our results show interesting trends in the data, as to what are the salient factors for the SEIR populaces in various JEL fields. There is no single explanatory factor, and our paper addresses only some of the trends and results to come from these data.

CHAPTER VI

CONCLUSION

Hypothesis and Results Evaluated

As we have discussed in Chapter 5, the uses of our results are broad ranging. They provide an interesting look at the big picture of the emergence and development of Economic sub-fields, but they can also be utilized to evaluate individual sub-disciplines. For our work, we chose to look at the broader picture, because of the interesting conclusions it has for the field. We found that our original assumption that complexity would have a significant effect on diffusion was null. The coefficients for the latency time of JEL's were negative in almost all cases, meaning for the purposes of this work they were considered as zero. In the few instances where they were positives, they were small enough values as to not be significantly different from zero. As such, we conclude that there is little difference in apprenticeship time between Economic sub-fields, and due to that homogeneity, it does not particularly inform the spread of sub-disciplines.

As expected, we did find the inclusion of interpersonal relationships was significant to the spread of a sub-field. The probability and effectiveness of multiple contacts, as well as the probability of effective contact, both inform the growth of infected classes in significant ways. We also came to interesting conclusions about the implication of negative values in these coefficients. They are actually a signal about the characteristics of individuals in a field. They can indicate the presence of a highly social individual, or a recluse. They can also tell us whether the individuals in the field are persuasive and thus effective in recruiting others to their field, or if they are driving individuals away from their field. It would appear in both cases that a sub-field can still experience growth in spite of the possible negative impacts from these parameters, but it does make an interesting statement about the effect of the individuals in a given discipline.

One result we did not anticipate was the discovery of the concept of 'gateway' fields, where individuals quickly exit the sub-discipline, presumably to move into a specialization. Unfortunately, we are unclear as to the effects of this on the development and growth of a field – in many cases you see high entry rates to these fields, but also high exit rates – but it is an interesting and noteworthy phenomenon.

Overall, we see some surprising and interesting results as to what informs the development of a field. There are still many conclusions to be drawn from this work, and we hope to evaluate the effects more in depth in future research.

Implications of Work

The implications of this work are two-fold. Firstly, it appears that the content of an economics field, while important (i.e. dominant fields can grow in spite of weak individuals), the development of one's field is benefitted enormously by having charismatic and sociable economists publishing in said field. Strong individuals can help carry a field, and foster its development, simply through the characteristics they bring to the table. This result begs the question (should one want to promote growth in their field), how does one recruit the sort of individuals that will advance development? And more importantly, what does that individual look like? Based on our data we argue that fields wants someone persuasive and sociable, because they are more likely to sell people on the value of their work, and are also more effective at outreach. However, without examination of the specific individuals, their work, and their fields, it is hard to say beyond generalizations what is so desirable or encouraging about these individuals. Is it something that is conveyed in their writing style, is it the approach they take to disseminating their work, or is it something entirely different? We unfortunately cannot answer that at this point in time, but it is an important question should we wish to pursue identifying these individuals and inducting them into our disciplines.

There is also the possible implication that should we be able to accurately portray the growth and death of economic sub-fields, we can then utilize that information to see how to best structure curriculum and programs of study in order to maximize the number of people we are attracting into the field. It also has possible benefits for designing curricula that will encourage growth and help maximize retention of students. Similarly, should we be able to accurately portray the development of sub-disciplines, it could be applied to funding decisions, in order to maximize the utility one is receiving from research funds. There are of course, moral questions - is it acceptable to "kill" a field, or hasten its death by eliminating its research funding, on the basis that it is already a dying field? While actions such as those would be cause for debate, it does have implications for the decisions we would have to make, should be able to accurately predict which sub-fields are becoming extinct.

Areas for Future Research

There are many opportunities for pursuing this work further. There is of course, the opportunity to address the questions posed above – what individuals are we looking for, and how do we attract them into our disciplines? Additionally, as frequently referenced, these data can be utilized in many other ways. We have chosen to use it to look at a broad picture, but it could be easily used to look at select disciplines. Focusing on sub-fields would allow us to more clearly see the trends within given fields, and consider how to possibly modify those trends, based on the parameters of a given field. There is also the opportunity to build significantly on the theoretical methods of this work.

As we addressed in our results, there are still many limitations to this work, including the issue of serial correlation, and the inability to set bounds on the parameters. Refining this model to address those problems, as well as improving the fit to the data is a significant undertaking and area for continuing research.

Ultimately, these results are intriguing, not only for the portrait they paint of the field of Economics, but also for the possible implications and applications they could have. We hope to pursue this model further, in order to develop a more robust portrait of what drives the emergence and development of Economics sub-disciplines.

APPENDIX A

JEL CODES

A - General Economics and Teaching
- A1 - General Economics
  - A10 - General
  - A11 - Role of Economics; Role of Economists; Market for Economists
  - A12 - Relation of Economics to Other Disciplines
  - A13 - Relation of Economics to Social Values
  - A14 - Sociology of Economics
  - A19 - Other

A2 - Economic Education and Teaching of Economics
  - A20 - General
  - A21 - Pre-college
  - A22 - Undergraduate
  - A23 - Graduate
  - A29 - Other

- A3 - Collective Works
  - A30 - General
  - A31 - Collected Writings of Individuals
  - A32 - Volumes
  - A33 - Handbooks
  - A39 - Other

B - History of Economic Thought, Methodology, and Heterodox Approaches
- B0 - General
  - B00 - General

- B1 - History of Economic Thought through 1925
  - B10 - General
  - B11 - Preclassical (Ancient, Medieval, Mercantilist, Physiocratic)
  - B12 - Classical
  - B13 - Neoclassical through 1925 (Australian, Marshallian, Walrasian, Stockholm School)
  - B14 - Socialist; Marxist
  - B15 - Historical; Institutional; Evolutionary
  - B16 - History of Economic Thought: Quantitative and Mathematical
  - B19 - Other

- B2 - History of Economic Thought since 1925
  - B20 - General
  - B21 - Microeconomics
  - B22 - Macroeconomics
  - B23 - History of Economic Thought: Econometrics; Quantitative and

Mathematical Studies
B24 - Socialist; Marxist; Sraffian
B25 - Historical; Institutional; Evolutionary; Austrian
B26 - Financial Economics
B29 - Other

B3 - History of Economic Thought: Individuals
B30 - General
B31 - Individuals
B32 - Obituaries

B4 - Economic Methodology
B40 - General
B41 - Economic Methodology
B49 - Other

B5 - Current Heterodox Approaches
B50 - General
B51 - Socialist; Marxian; Sraffian
B52 - Institutional; Evolutionary
B53 - Austrian
B54 - Feminist Economics
B59 - Other

C - Mathematical and Quantitative Methods
C0 - General
C00 - General
C01 - Econometrics
C02 - Mathematical Methods

C1 - Econometric and Statistical Methods and Methodology: General
C10 - General
C11 - Bayesian Analysis: General
C12 - Hypothesis Testing: General
C13 - Estimation: General
C14 - Semiparametric and Nonparametric Methods: General
C15 - Statistical Simulation Methods: General
C16 - Specific Distributions
C18 - Methodological Issues: General
C19 - Other

C2 - Single Equation Models; Single Variables
C20 - General
C21 - Cross-Sectional Models; Spatial Models; Treatment Effect Models; Quantile Regressions
C22 - Time-Series Models; Dynamic Quantile Regressions; Dynamic Treatment Models

C23 - Models with Panel Data; Longitudinal Data; Spatial Time Series
C24 - Truncated and Censored Models; Switching Regression Models
C25 - Discrete Regression and Qualitative Choice Models; Discrete Regressors; Proportions
C26 - Instrumental Variables (IV) Estimation
C29 - Other

C3 - Multiple or Simultaneous Equation Models; Multiple Variables
C30 - General
C31 - Cross-Sectional Models; Spatial Models; Treatment Effect Models; Quantile Regressions; Social Interaction Models
C32 - Time-Series Models; Dynamic Quantile Regressions; Dynamic Treatment Models
C33 - Models with Panel Data; Longitudinal Data; Spatial Time Series
C34 - Truncated and Censored Models; Switching Regression Models
C35 - Discrete Regression and Qualitative Choice Models; Discrete Regressors; Proportions
C36 - Instrumental Variables (IV) Estimation
C38 - Classification Methods; Cluster Analysis; Factor Analysis
C39 - Other

C4 - Econometric and Statistical Methods: Special Topics
C40 - General
C41 - Duration Analysis; Optimal Timing Strategies
C43 - Index Numbers and Aggregation
C44 - Statistical Decision Theory; Operations Research
C45 - Neural Networks and Related Topics
C46 - Specific Distributions; Specific Statistics
C49 - Other

C5 - Econometric Modeling
C50 - General
C51 - Model Construction and Estimation
C52 - Model Evaluation, Validation, and Selection
C53 - Forecasting Models; Simulation Methods
C54 - Quantitative Policy Modeling
C58 - Financial Econometrics
C59 - Other

C6 - Mathematical Methods; Programming Models; Mathematical and Simulation Modeling
C60 - General
C61 - Optimization Techniques; Programming Models; Dynamic Analysis
C62 - Existence and Stability Conditions of Equilibrium
C63 - Computational Techniques; Simulation Modeling
C65 - Miscellaneous Mathematical Tools

C67 - Input–Output Models
C68 - Computable General Equilibrium Models
C69 - Other

C7 - Game Theory and Bargaining Theory
C70 - General
C71 - Cooperative Games
C72 - Noncooperative Games
C73 - Stochastic and Dynamic Games; Evolutionary Games; Repeated Games
C78 - Bargaining Theory; Matching Theory
C79 - Other

C8 - Data Collection and Data Estimation Methodology; Computer Programs
C80 - General
C81 - Methodology for Collecting, Estimating, and Organizing Microeconomic Data; Data Analysis
C82 - Methodology for Collecting, Estimating, and Organizing Macroeconomic Data; Data Analysis
C83 - Survey Methods; Sampling Methods
C87 - Econometric Software
C88 - Other Computer Software
C89 - Other

C9 - Design of Experiments
C90 - General
C91 - Laboratory, Individual Behavior
C92 - Laboratory, Group Behavior
C93 - Field Experiments
C99 - Other

D - Microeconomics
D0 - General
D00 - General
D01 - Microeconomic Behavior: Underlying Principles
D02 - Institutions: Design, Formation, and Operations
D03 - Behavioral Economics; Underlying Principles
D04 - Microeconomic Policy: Formulation; Implementation; Evaluation

D1 - Household Behavior and Family Economics
D10 - General
D11 - Consumer Economics: Theory
D12 - Consumer Economics: Empirical Analysis
D13 - Household Production and Intrahousehold Allocation
D14 - Personal Finance
D18 - Consumer Protection
D19 - Other

D2 - Production and Organizations
- D20 - General
- D21 - Firm Behavior: Theory
- D22 - Firm Behavior: Empirical Analysis
- D23 - Organizational Behavior; Transaction Costs; Property Rights
- D24 - Production; Cost; Capital, Total Factor, and Multifactor Productivity; Capacity
- D29 - Other

D3 - Distribution
- D30 - General
- D31 - Personal Income, Wealth, and Their Distributions
- D33 - Factor Income Distribution
- D39 - Other

D4 - Market Structure and Pricing
- D40 - General
- D41 - Perfect Competition
- D42 - Monopoly
- D43 - Oligopoly and Other Forms of Market Imperfection
- D44 - Auctions
- D45 - Rationing; Licensing
- D46 - Value Theory
- D49 - Other

D5 - General Equilibrium and Disequilibrium
- D50 - General
- D51 - Exchange and Production Economies
- D52 - Incomplete Markets
- D53 - Financial Markets
- D57 - Input–Output Tables and Analysis
- D58 - Computable and Other Applied General Equilibrium Models
- D59 - Other

D6 - Welfare Economics
- D60 - General
- D61 - Allocative Efficiency; Cost–Benefit Analysis
- D62 - Externalities
- D63 - Equity, Justice, Inequality, and Other Normative Criteria and Measurement
- D64 - Altruism
- D69 - Other

D7 - Analysis of Collective Decision-Making
- D70 - General
- D71 - Social Choice; Clubs; Committees; Associations
- D72 - Political Processes: Rent-Seeking, Lobbying, Elections,

Legislatures, and Voting Behavior
D73 - Bureaucracy; Administrative Processes in Public Organizations; Corruption
D74 - Conflict; Conflict Resolution; Alliances
D78 - Positive Analysis of Policy-Making and Implementation
D79 - Other

D8 - Information, Knowledge, and Uncertainty
D80 - General
D81 - Criteria for Decision-Making under Risk and Uncertainty
D82 - Asymmetric and Private Information
D83 - Search; Learning; Information and Knowledge; Communication; Belief
D84 - Expectations; Speculations
D85 - Network Formation and Analysis: Theory
D86 - Economics of Contract: Theory
D87 - Neuroeconomics
D89 - Other

D9 - Intertemporal Choice and Growth
D90 - General
D91 - Intertemporal Consumer Choice; Life Cycle Models and Saving
D92 - Intertemporal Firm Choice and Growth, Financing, Investment, and Capacity
D99 - Other

E - Macroeconomics and Monetary Economics
E0 - General
E00 - General
E01 - Measurement and Data on National Income and Product Accounts and Wealth; Environmental Accounts
E02 - Institutions and the Macroeconomy

E1 - General Aggregative Models
E10 - General
E11 - Marxian; Sraffian; Institutional; Evolutionary
E12 - Keynes; Keynesian; Post-Keynesian
E13 - Neoclassical
E17 - Forecasting and Simulation: Models and Applications
E19 - Other

E2 - Macroeconomics: Consumption, Saving, Production, Employment, and Investment
E20 - General
E21 - Consumption; Saving; Wealth
E22 - Capital; Investment; Capacity
E23 - Production

- E24 - Employment; Unemployment; Wages; Intergenerational Income Distribution; Aggregate Human Capital
- E25 - Aggregate Factor Income Distribution
- E26 - Informal Economy; Underground Economy
- E27 - Forecasting and Simulation: Models and Applications
- E29 - Other

E3 - Prices, Business Fluctuations, and Cycles

- E30 - General
- E31 - Price Level; Inflation; Deflation
- E32 - Business Fluctuations; Cycles
- E37 - Forecasting and Simulation: Models and Applications
- E39 - Other

E4 - Money and Interest Rates

- E40 - General
- E41 - Demand for Money
- E42 - Monetary Systems; Standards; Regimes; Government and the Monetary System; Payment Systems
- E43 - Interest Rates: Determination, Term Structure, and Effects
- E44 - Financial Markets and the Macroeconomy
- E47 - Forecasting and Simulation: Models and Applications
- E49 - Other

E5 - Monetary Policy, Central Banking, and the Supply of Money and Credit

- E50 - General
- E51 - Money Supply; Credit; Money Multipliers
- E52 - Monetary Policy
- E58 - Central Banks and Their Policies
- E59 - Other

E6 - Macroeconomic Policy, Macroeconomic Aspects of Public Finance, and General Outlook

- E60 - General
- E61 - Policy Objectives; Policy Designs and Consistency; Policy Coordination
- E62 - Fiscal Policy
- E63 - Comparative or Joint Analysis of Fiscal and Monetary Policy; Stabilization; Treasury Policy
- E64 - Incomes Policy; Price Policy
- E65 - Studies of Particular Policy Episodes
- E66 - General Outlook and Conditions
- E69 - Other

F - International Economics

F0 - General

F00 - General
F01 - Global Outlook
F02 - International Economic Order

F1 - Trade
F10 - General
F11 - Neoclassical Models of Trade
F12 - Models of Trade with Imperfect Competition and Scale Economies
F13 - Trade Policy; International Trade Organizations
F14 - Country and Industry Studies of Trade
F15 - Economic Integration
F16 - Trade and Labor Market Interactions
F17 - Trade Forecasting and Simulation
F18 - Trade and Environment
F19 - Other

F2 - International Factor Movements and International Business
F20 - General
F21 - International Investment; Long-Term Capital Movements
F22 - International Migration
F23 - Multinational Firms; International Business
F24 - Remittances
F29 - Other

F3 - International Finance
F30 - General
F31 - Foreign Exchange
F32 - Current Account Adjustment; Short-Term Capital Movements
F33 - International Monetary Arrangements and Institutions
F34 - International Lending and Debt Problems
F35 - Foreign Aid
F36 - Financial Aspects of Economic Integration
F37 - International Finance Forecasting and Simulation: Models and Applications
F39 - Other

F4 - Macroeconomic Aspects of International Trade and Finance
F40 - General
F41 - Open Economy Macroeconomics
F42 - International Policy Coordination and Transmission
F43 - Economic Growth of Open Economies
F44 - International Business Cycles
F47 - Forecasting and Simulation: Models and Applications
F49 - Other

F5 - International Relations and International Political Economy
- F50 - General
- F51 - International Conflicts; Negotiations; Sanctions
- F52 - National Security; Economic Nationalism
- F53 - International Agreements and Observance; International Organizations
- F54 - Colonialism; Imperialism; Postcolonialism
- F55 - International Institutional Arrangements
- F59 - International Relations and International Political Economy: Other

G - Financial Economics

G0 - General
- G00 - General
- G01 - Financial Crises

G1 - General Financial Markets
- G10 - General
- G11 - Portfolio Choice; Investment Decisions
- G12 - Asset Pricing; Trading volume; Bond Interest Rates
- G13 - Contingent Pricing; Futures Pricing
- G14 - Information and Market Efficiency; Event Studies
- G15 - International Financial Markets
- G17 - Financial Forecasting and Simulation
- G18 - Government Policy and Regulation
- G19 - Other

G2 - Financial Institutions and Services
- G20 - General
- G21 - Banks; Other Depository Institutions; Micro Finance Institutions; Mortgages
- G22 - Insurance; Insurance Companies
- G23 - Pension Funds; Other Private Financial Institutions
- G24 - Investment Banking; Venture Capital; Brokerage; Ratings and Ratings Agencies
- G28 - Government Policy and Regulation
- G29 - Other

G3 - Corporate Finance and Governance
- G30 - General
- G31 - Capital Budgeting; Fixed Investment and Inventory Studies; Capacity
- G32 - Financing Policy; Financial Risk and Risk Management; Capital and Ownership Structure
- G33 - Bankruptcy; Liquidation
- G34 - Mergers; Acquisitions; Restructuring; Corporate Governance
- G35 - Payout Policy

G38 - Government Policy and Regulation
G39 - Other

H - Public Economics
H0 - General
H00 - General

H1 - Structure and Scope of Government
H10 - General
H11 - Structure, Scope, and Performance of Government
H12 - Crisis Management
H19 - Other

H2 - Taxation, Subsidies, and Revenue
H20 - General
H21 - Efficiency; Optimal Taxation
H22 - Incidence
H23 - Externalities; Redistributive Effects; Environmental Taxes and Subsidies
H24 - Personal Income and Other Nonbusiness Taxes and Subsidies
H25 - Business Taxes and Subsidies
H26 - Tax Evasion
H27 - Other Sources of Revenue
H29 - Other

H3 - Fiscal Policies and Behavior of Economic Agents
H30 - General
H31 - Household
H32 - Firm
H39 - Other

H4 - Publicly Provided Goods
H40 - General
H41 - Public Goods
H42 - Publicly Provided Private Goods
H43 - Project Evaluation; Social Discount Rate
H44 - Publicly Provided Goods: Mixed Markets
H49 - Other

H5 - National Government Expenditures and Related Policies
H50 - General
H51 - Government Expenditures and Health
H52 - Government Expenditures and Education
H53 - Government Expenditures and Welfare Programs
H54 - Infrastructures; Other Public Investment and Capital Stock
H55 - Social Security and Public Pensions
H56 - National Security and War

- H57 - Procurement
- H59 - Other

H6 - National Budget, Deficit, and Debt

- H60 - General
- H61 - Budget; Budget Systems
- H62 - Deficit; Surplus
- H63 - Debt; Debt Management; Sovereign Debt
- H68 - Forecasts of Budgets, Deficits, and Debt
- H69 - Other

H7 - State and Local Government; Intergovernmental Relations

- H70 - General
- H71 - State and Local Taxation, Subsidies, and Revenue
- H72 - State and Local Budget and Expenditures
- H73 - Interjurisdictional Differentials and Their Effects
- H74 - State and Local Borrowing
- H75 - State and Local Government: Health; Education; Welfare; Public Pensions
- H76 - State and Local Government: Other Expenditure Categories
- H77 - Intergovernmental Relations; Federalism; Secession
- H79 - Other

H8 - Miscellaneous Issues

- H80 - General
- H81 - Governmental Loans, Loan Guarantees, Credits, and Grants
- H82 - Governmental Property
- H83 - Public Administration; Public Sector Accounting and Audits
- H87 - International Fiscal Issues; International Public Goods
- H89 - Other

I - Health, Education, and Welfare

I0 - General

- I00 - General

I1 - Health

- I10 - General
- I11 - Analysis of Health Care Markets
- I12 - Health Production
- I14 - Health and Inequality
- I15 - Health and Economic Development
- I18 - Government Policy; Regulation; Public Health
- I19 - Other

I2 - Education and Research Institutions

- I20 - General
- I21 - Analysis of Education

I22 - Educational Finance
I23 - Higher Education and Research Institutions
I24 - Education and Inequality
I25 - Education and Economic Development
I28 - Government Policy
I29 - Other

I3 - Welfare and Poverty
I30 - General
I31 - General Welfare
I32 - Measurement and Analysis of Poverty
I38 - Government Policy; Provision and Effects of Welfare Programs
I39 - Other

J - Labor and Demographic Economics
J0 - General
J00 - General
J01 - Labor Economics: General
J08 - Labor Economics Policies

J1 - Demographic Economics
J10 - General
J11 - Demographic Trends and Forecasts
J12 - Marriage; Marital Dissolution; Family Structure; Domestic Abuse
J13 - Fertility; Family Planning; Child Care; Children; Youth
J14 - Economics of the Elderly; Economics of the Handicapped; Non-Labor Market Discrimination
J15 - Economics of Minorities and Races; Non-labor Discrimination
J16 - Economics of Gender; Non-labor Discrimination
J17 - Value of Life; Forgone Income
J18 - Public Policy
J19 - Other

J2 - Demand and Supply of Labor
J20 - General
J21 - Labor Force and Employment, Size, and Structure
J22 - Time Allocation and Labor Supply
J23 - Labor Demand
J24 - Human Capital; Skills; Occupational Choice; Labor Productivity
J26 - Retirement; Retirement Policies
J28 - Safety; Job Satisfaction; Related Public Policy
J29 - Other

J3 - Wages, Compensation, and Labor Costs
J30 - General
J31 - Wage Level and Structure; Wage Differentials
J32 - Nonwage Labor Costs and Benefits; Private Pensions

- J33 - Compensation Packages; Payment Methods
- J38 - Public Policy
- J39 - Other

J4 - Particular Labor Markets

- J40 - General
- J41 - Labor Contracts
- J42 - Monopsony; Segmented Labor Markets
- J43 - Agricultural Labor Markets
- J44 - Professional Labor Markets; Occupational Licensing
- J45 - Public Sector Labor Markets
- J47 - Coercive Labor Markets
- J48 - Public Policy
- J49 - Other

J5 - Labor–Management Relations, Trade Unions, and Collective Bargaining

- J50 - General
- J51 - Trade Unions: Objectives, Structure, and Effects
- J52 - Dispute Resolution: Strikes, Arbitration, and Mediation; Collective Bargaining
- J53 - Labor–Management Relations; Industrial Jurisprudence
- J54 - Producer Cooperatives; Labor Managed Firms; Employee Ownership
- J58 - Public Policy
- J59 - Other

J6 - Mobility, Unemployment, and Vacancies

- J60 - General
- J61 - Geographic Labor Mobility; Immigrant Workers
- J62 - Job, Occupational, and Intergenerational Mobility
- J63 - Turnover; Vacancies; Layoffs
- J64 - Unemployment: Models, Duration, Incidence, and Job Search
- J65 - Unemployment Insurance; Severance Pay; Plant Closings
- J68 - Public Policy
- J69 - Other

J7 - Labor Discrimination

- J70 - General
- J71 - Discrimination
- J78 - Public Policy
- J79 - Other

J8 - Labor Standards: National and International

- J80 - General
- J81 - Working Conditions
- J82 - Labor Force Composition
- J83 - Workers' Rights

J88 - Public Policy
J89 - Other

K - Law and Economics
K0 - General
K00 - General

K1 - Basic Areas of Law
K10 - General
K11 - Property Law
K12 - Contract Law
K13 - Tort Law and Product Liability
K14 - Criminal Law
K19 - Other

K2 - Regulation and Business Law
K20 - General
K21 - Antitrust Law
K22 - Corporation and Securities Law
K23 - Regulated Industries and Administrative Law
K29 - Other

K3 - Other Substantive Areas of Law
K30 - General
K31 - Labor Law
K32 - Environmental, Health, and Safety Law
K33 - International Law
K34 - Tax Law
K35 - Personal Bankruptcy Law
K36 - Family and Personal Law
K39 - Other

K4 - Legal Procedure, the Legal System, and Illegal Behavior
K40 - General
K41 - Litigation Process
K42 - Illegal Behavior and the Enforcement of Law
K49 - Other

L - Industrial Organization
L0 - General
L00 - General

L1 - Market Structure, Firm Strategy, and Market Performance
L10 - General
L11 - Production, Pricing, and Market Structure; Size Distribution of Firms
L12 - Monopoly; Monopolization Strategies

L13 - Oligopoly and Other Imperfect Markets
L14 - Transactional Relationships; Contracts and Reputation; Networks
L15 - Information and Product Quality; Standardization and Compatibility
L16 - Industrial Organization and Macroeconomics: Industrial Structure and Structural Change; Industrial Price Indices
L17 - Open Source Products and Markets
L19 - Other

L2 - Firm Objectives, Organization, and Behavior
L20 - General
L21 - Business Objectives of the Firm
L22 - Firm Organization and Market Structure
L23 - Organization of Production
L24 - Contracting Out; Joint Ventures; Technology Licensing
L25 - Firm Performance: Size, Diversification, and Scope
L26 - Entrepreneurship
L29 - Other

L3 - Nonprofit Organizations and Public Enterprise
L30 - General
L31 - Nonprofit Institutions; NGOs
L32 - Public Enterprises; Public-Private Enterprises
L33 - Comparison of Public and Private Enterprises and Nonprofit Institutions; Privatization; Contracting Out
L38 - Public Policy
L39 - Other

L4 - Antitrust Issues and Policies
L40 - General
L41 - Monopolization; Horizontal Anticompetitive Practices
L42 - Vertical Restraints; Resale Price Maintenance; Quantity Discounts
L43 - Legal Monopolies and Regulation or Deregulation
L44 - Antitrust Policy and Public Enterprises, Nonprofit Institutions, and Professional Organizations
L49 - Other

L5 - Regulation and Industrial Policy
L50 - General
L51 - Economics of Regulation
L52 - Industrial Policy; Sectoral Planning Methods
L53 - Enterprise Policy
L59 - Other

L6 - Industry Studies: Manufacturing

L60 - General
L61 - Metals and Metal Products; Cement; Glass; Ceramics
L62 - Automobiles; Other Transportation Equipment
L63 - Microelectronics; Computers; Communications Equipment
L64 - Other Machinery; Business Equipment; Armaments
L65 - Chemicals; Rubber; Drugs; Biotechnology
L66 - Food; Beverages; Cosmetics; Tobacco; Wine and Spirits
L67 - Other Consumer Nondurables: Clothing, Textiles, Shoes, and Leather
L68 - Appliances; Other Consumer Durables
L69 - Other

L7 - Industry Studies: Primary Products and Construction
L70 - General
L71 - Mining, Extraction, and Refining: Hydrocarbon Fuels
L72 - Mining, Extraction, and Refining: Other Nonrenewable Resources
L73 - Forest Products
L74 - Construction
L78 - Government Policy
L79 - Other

L8 - Industry Studies: Services
L80 - General
L81 - Retail and Wholesale Trade; e-Commerce
L82 - Entertainment; Media
L83 - Sports; Gambling; Recreation; Tourism
L84 - Personal, Professional, and Business Services
L85 - Real Estate Services
L86 - Information and Internet Services; Computer Software
L87 - Postal and Delivery Services
L88 - Government Policy
L89 - Other

L9 - Industry Studies: Transportation and Utilities
L90 - General
L91 - Transportation: General
L92 - Railroads and Other Surface Transportation
L93 - Air Transportation
L94 - Electric Utilities
L95 - Gas Utilities; Pipelines; Water Utilities
L96 - Telecommunications
L97 - Utilities: General
L98 - Government Policy
L99 - Other

M - Business Administration and Business Economics; Marketing; Accounting
- M0 - General
  - M00 - General
- M1 - Business Administration
  - M10 - General
  - M11 - Production Management
  - M12 - Personnel Management; Executive Compensation
  - M13 - New Firms; Startups
  - M14 - Corporate Culture; Social Responsibility
  - M15 - IT Management
  - M16 - International Business Administration
  - M19 - Other
- M2 - Business Economics
  - M20 - General
  - M21 - Business Economics
  - M29 - Other
- M3 - Marketing and Advertising
  - M30 - General
  - M31 - Marketing
  - M37 - Advertising
  - M38 - Government Policy and Regulation
  - M39 - Other
- M4 - Accounting and Auditing
  - M40 - General
  - M41 - Accounting
  - M42 - Auditing
  - M48 - Government Policy and Regulation
  - M49 - Other
- M5 - Personnel Economics
  - M50 - General
  - M51 - Firm Employment Decisions; Promotions
  - M52 - Compensation and Compensation Methods and Their Effects
  - M53 - Training
  - M54 - Labor Management
  - M55 - Labor Contracting Devices
  - M59 - Other

N - Economic History
- N0 - General
  - N00 - General
  - N01 - Development of the Discipline: Historiographical; Sources and Methods

N1 - Macroeconomics and Monetary Economics; Growth and Fluctuations
- N10 - General, International, or Comparative
- N11 - U.S.; Canada: Pre-1913
- N12 - U.S.; Canada: 1913–
- N13 - Europe: Pre-1913
- N14 - Europe: 1913–
- N15 - Asia including Middle East
- N16 - Latin America; Caribbean
- N17 - Africa; Oceania

N2 - Financial Markets and Institutions
- N20 - General, International, or Comparative
- N21 - U.S.; Canada: Pre-1913
- N22 - U.S.; Canada: 1913–
- N23 - Europe: Pre-1913
- N24 - Europe: 1913–
- N25 - Asia including Middle East
- N26 - Latin America; Caribbean
- N27 - Africa; Oceania

N3 - Labor and Consumers, Demography, Education, Health, Welfare, Income, Wealth, Religion, and Philanthropy
- N30 - General, International, or Comparative
- N31 - U.S.; Canada: Pre-1913
- N32 - U.S.; Canada: 1913-
- N33 - Europe: Pre-1913
- N34 - Europe: 1913-
- N35 - Asia including Middle East
- N36 - Latin America; Caribbean
- N37 - Africa; Oceania

N4 - Government, War, Law, International Relations, and Regulation
- N40 - General, International, or Comparative
- N41 - U.S.; Canada: Pre-1913
- N42 - U.S.; Canada: 1913–
- N43 - Europe: Pre-1913
- N44 - Europe: 1913–
- N45 - Asia including Middle East
- N46 - Latin America; Caribbean
- N47 - Africa; Oceania

N5 - Agriculture, Natural Resources, Environment, and Extractive Industries
- N50 - General, International, or Comparative
- N51 - U.S.; Canada: Pre-1913
- N52 - U.S.; Canada: 1913–
- N53 - Europe: Pre-1913
- N54 - Europe: 1913–

N55 - Asia including Middle East
N56 - Latin America; Caribbean
N57 - Africa; Oceania

N6 - Manufacturing and Construction
N60 - General, International, or Comparative
N61 - U.S.; Canada: Pre-1913
N62 - U.S.; Canada: 1913–
N63 - Europe: Pre-1913
N64 - Europe: 1913–
N65 - Asia including Middle East
N66 - Latin America; Caribbean
N67 - Africa; Oceania

N7 - Transport, Trade, Energy, Technology, and Other Services
N70 - General, International, or Comparative
N71 - U.S.; Canada: Pre-1913
N72 - U.S.; Canada: 1913–
N73 - Europe: Pre-1913
N74 - Europe: 1913–
N75 - Asia including Middle East
N76 - Latin America; Caribbean
N77 - Africa; Oceania

N8 - Micro-Business History
N80 - General, International, or Comparative
N81 - U.S.; Canada: Pre-1913
N82 - U.S.; Canada: 1913–
N83 - Europe: Pre-1913
N84 - Europe: 1913–
N85 - Asia including Middle East
N86 - Latin America; Caribbean
N87 - Africa; Oceania

N9 - Regional and Urban History
N90 - General, International, or Comparative
N91 - U.S.; Canada: Pre-1913
N92 - U.S.; Canada: 1913–
N93 - Europe: Pre-1913
N94 - Europe: 1913–
N95 - Asia including Middle East
N96 - Latin America; Caribbean
N97 - Africa; Oceania

O - Economic Development, Technological Change, and Growth
O1 - Economic Development

O10 - General
O11 - Macroeconomic Analyses of Economic Development
O12 - Microeconomic Analyses of Economic Development
O13 - Agriculture; Natural Resources; Energy; Environment; Other Primary Products
O14 - Industrialization; Manufacturing and Service Industries; Choice of Technology
O15 - Human Resources; Human Development; Income Distribution; Migration
O16 - Economic Development: Financial Markets; Saving and Capital Investment; Corporate Finance and Governance
O17 - Formal and Informal Sectors; Shadow Economy; Institutional Arrangements
O18 - Regional, Urban, and Rural Analyses; Transportation
O19 - International Linkages to Development; Role of International Organizations

O2 - Development Planning and Policy
O20 - General
O21 - Planning Models; Planning Policy
O22 - Project Analysis
O23 - Fiscal and Monetary Policy in Development
O24 - Trade Policy; Factor Movement Policy; Foreign Exchange Policy
O25 - Industrial Policy
O29 - Other

O3 - Technological Change; Research and Development
O30 - General
O31 - Innovation and Invention: Processes and Incentives
O32 - Management of Technological Innovation and R&D
O33 - Technological Change: Choices and Consequences; Diffusion Processes
O34 - Intellectual Property Rights
O38 - Government Policy
O39 - Other

O4 - Economic Growth and Aggregate Productivity
O40 - General
O41 - One, Two, and Multisector Growth Models
O42 - Monetary Growth Models
O43 - Institutions and Growth
O44 - Environment and Growth
O47 - Measurement of Economic Growth; Aggregate Productivity; Cross-Country Output Convergence
O49 - Other

O5 - Economywide Country Studies
- O50 - General
- O51 - U.S.; Canada
- O52 - Europe
- O53 - Asia including Middle East
- O54 - Latin America; Caribbean
- O55 - Africa
- O56 - Oceania
- O57 - Comparative Studies of Countries

P - Economic Systems

P0 - General
- P00 - General

P1 - Capitalist Systems
- P10 - General
- P11 - Planning, Coordination, and Reform
- P12 - Capitalist Enterprises
- P13 - Cooperative Enterprises
- P14 - Property Rights
- P16 - Political Economy
- P17 - Performance and Prospects
- P19 - Other

P2 - Socialist Systems and Transitional Economies
- P20 - General
- P21 - Planning, Coordination, and Reform
- P22 - Prices
- P23 - Factor and Product Markets; Industry Studies; Population
- P24 - National Income, Product, and Expenditure; Money; Inflation
- P25 - Urban, Rural, and Regional Economics
- P26 - Political Economy; Property Rights
- P27 - Performance and Prospects
- P28 - Natural Resources; Energy; Environment
- P29 - Other

P3 - Socialist Institutions and Their Transitions
- P30 - General
- P31 - Socialist Enterprises and Their Transitions
- P32 - Collectives; Communes; Agriculture
- P33 - International Trade, Finance, Investment, and Aid
- P34 - Financial Economics
- P35 - Public Economics
- P36 - Socialist Institutions and Their Transitions: Consumer Economics; Health; Education and Training; Welfare, Income, Wealth, and Poverty
- P37 - Legal Institutions; Illegal Behavior
- P39 - Other

P4 - Other Economic Systems
- P40 - General
- P41 - Planning, Coordination, and Reform
- P42 - Productive Enterprises; Factor and Product Markets; Prices; Population
- P43 - Public Economics; Financial Economics
- P44 - National Income, Product, and Expenditure; Money; Inflation
- P45 - International Trade, Finance, Investment, and Aid
- P46 - Consumer Economics; Health; Education and Training; Welfare, Income, Wealth, and Poverty
- P47 - Performance and Prospects
- P48 - Political Economy; Legal Institutions; Property Rights; Natural Resources; Energy; Environment; Regional Studies
- P49 - Other

P5 - Comparative Economic Systems
- P50 - General
- P51 - Comparative Analysis of Economic Systems
- P52 - Comparative Studies of Particular Economies
- P59 - Other

Q - Agricultural and Natural Resource Economics; Environmental and Ecological Economics

Q0 - General
- Q00 - General
- Q01 - Sustainable Development
- Q02 - Global Commodity Crises

Q1 - Agriculture
- Q10 - General
- Q11 - Aggregate Supply and Demand Analysis; Prices
- Q12 - Micro Analysis of Farm Firms, Farm Households, and Farm Input Markets
- Q13 - Agricultural Markets and Marketing; Cooperatives; Agribusiness
- Q14 - Agricultural Finance
- Q15 - Land Ownership and Tenure; Land Reform; Land Use; Irrigation; Agriculture and Environment
- Q16 - R&D; Agricultural Technology; Biofuels; Agricultural Extension Services
- Q17 - Agriculture in International Trade
- Q18 - Agricultural Policy; Food Policy
- Q19 - Other

Q2 - Renewable Resources and Conservation
- Q20 - General
- Q21 - Demand and Supply
- Q22 - Fishery; Aquaculture

Q23 - Forestry
Q24 - Land
Q25 - Water
Q26 - Recreational Aspects of Natural Resources
Q27 - Renewable Resources and Conservation: Issues in International Trade
Q28 - Government Policy
Q29 - Other

Q3 - Nonrenewable Resources and Conservation
Q30 - General
Q31 - Demand and Supply
Q32 - Exhaustible Resources and Economic Development
Q34 - Natural Resources and Domestic and International Conflicts
Q33 - Resource Booms
Q38 - Government Policy
Q39 - Other

Q4 - Energy
Q40 - General
Q41 - Demand and Supply
Q42 - Alternative Energy Sources
Q43 - Energy and the Macroeconomy
Q47 - Energy Forecasting
Q48 - Government Policy
Q49 - Other

Q5 - Environmental Economics
Q50 - General
Q51 - Valuation of Environmental Effects
Q52 - Pollution Control Adoption Costs; Distributional Effects; Employment Effects
Q53 - Air Pollution; Water Pollution; Noise; Hazardous Waste; Solid Waste; Recycling
Q54 - Climate; Natural Disasters; Global Warming
Q55 - Technological Innovation
Q56 - Environment and Development; Environment and Trade; Sustainability; Environmental Accounts and Accounting; Environmental Equity; Population Growth
Q57 - Ecological Economics: Ecosystem Services; Biodiversity Conservation; Bioeconomics; Industrial Ecology
Q58 - Government Policy
Q59 - Other

R - Urban, Rural, and Regional Economics
R0 - General
R00 - General

R1 - General Regional Economics
- R10 - General
- R11 - Regional Economic Activity: Growth, Development, and Changes
- R12 - Size and Spatial Distributions of Regional Economic Activity
- R13 - General Equilibrium and Welfare Economic Analysis of Regional Economies
- R14 - Land Use Patterns
- R15 - Econometric and Input–Output Models; Other Models
- R19 - Other

R2 - Household Analysis
- R20 - General
- R21 - Housing Demand
- R22 - Other Demand
- R23 - Regional Migration; Regional Labor Markets; Population; Neighborhood Characteristics
- R28 - Government Policy
- R29 - Other

R3 - Housing Markets, Production Analysis, and Firm Location
- R30 - General
- R31 - Housing Supply and Markets
- R32 - Other Production and Pricing Analysis
- R33 - Nonagricultural and Nonresidential Real Estate Markets
- R34 - Input Demand Analysis
- R38 - Government Policies; Regulatory Policies
- R39 - Other

R4 - Transportation Systems
- R40 - General
- R41 - Transportation: Demand, Supply, and Congestion; Safety and Accidents; Transportation Noise
- R42 - Government and Private Investment Analysis; Road Maintenance; Transportation Planning
- R48 - Government Pricing; Regulatory Policies; Transportation Planning
- R49 - Other

R5 - Regional Government Analysis
- R50 - General
- R51 - Finance in Urban and Rural Economies
- R52 - Land Use and Other Regulations
- R53 - Public Facility Location Analysis; Public Investment and Capital Stock
- R58 - Regional Development Planning and Policy
- R59 - Other

Y - Miscellaneous Categories
- Y1 - Data: Tables and Charts
  - Y10 - Data: Tables and Charts
- Y2 - Introductory Material
  - Y20 - Introductory Material
- Y3 - Book Reviews (unclassified)
  - Y30 - Book Reviews (unclassified)
- Y4 - Dissertations (unclassified)
  - Y40 - Dissertations (unclassified)
- Y5 - Further Reading (unclassified)
  - Y50 - Further Reading (unclassified)
- Y6 - Excerpts
  - Y60 - Excerpts
- Y7 - No Author General Discussions
  - Y70 - No Author General Discussions
- Y8 - Related Disciplines
  - Y80 - Related Disciplines
- Y9 - Other
  - Y90 - Other
  - Y91 - Pictures and Maps

Z - Other Special Topics
- Z0 - General
  - Z00 - General
- Z1 - Cultural Economics; Economic Sociology; Economic Anthropology
  - Z10 - General
  - Z11 - Economics of the Arts and Literature
  - Z12 - Religion
  - Z13 - Economic Sociology; Economic Anthropology; Social and Economic Stratification
  - Z19 - Other

APPENDIX B

DURBIN-WATSON STATISTICS

JEL	A10	A11	A12	A13	A14	A19	A20	A21	A22	A23	A29	B00	B10
Durbin-Watson for Susceptible	1.00905	0.8083	1.0184	1.01165	1.04954	1.03859	1.00075	1.0282	0.81217	0.81998	1.05775	1.03373	0.86767
Durbin-Watson for Exposed	1.90237	1.89388	1.63695	1.70652	1.868	1.98245	1.38686	1.90465	2.21041	2.00155	1.78926	1.15716	0.92747
Durbin-Watson for Infected	2.59335	2.1528	2.735	2.34828	1.89823	2.02245	2.555	1.73001	2.37528	1.90753	2.11671	1.89377	1.79189
Durbin-Watson for Recovered	2.70049	2.81227	2.56328	2.79897	2.30706	2.95772	2.89765	2.15499	2.38893	2.9596	2.52606	2.55291	2.60707
Auto-Correlation Test for Susceptible	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto-Correlation Test for Exposed	1	1	0	0	1	1	0	1	1	1	1	0	0
Auto-Correlation Test for Infected	1	1	1	1	1	1	1	1	1	1	1	1	1
Auto-Correlation Test for Recovered	1	1	1	1	1	1	1	0	1	1	1	1	1

JEL	B11	B12	B13	B14	B15	B16	B19	B20	B21	B22	B23	B24	B25
Durbin-Watson for Susceptible	1.01799	0.98008	0.70945	0.75129	1.00418	0.79059	0.94416	0.3898	0.87976	0.69624	0.79065	0.87121	0.96206
Durbin-Watson for Exposed	1.16866	1.17986	0.51321	0.54328	1.14959	0.77097	1.31947	0.32771	1.02344	0.54224	0.51588	1.32727	1.26058
Durbin-Watson for Infected	2.84972	2.06728	1.41327	2.31237	1.81357	1.19833	2.34671	1.3717	3.10956	2.70105	1.9887	2.39716	2.11085
Durbin-Watson for Recovered	3.27552	2.40637	2.0103	3.26511	2.19268	1.53919	2.76442	2.48413	3.16692	3.16321	2.71312	3.05507	2.66111
Auto-Correlation Test for Susceptible	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto-Correlation Test for Exposed	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto-Correlation Test for Infected	1	1	1	1	1	0	1	1	1	1	1	1	1
Auto-Correlation Test for Recovered	1	1	0	1	1	0	1	0	1	1	1	1	1

JEL	B29	B30	B31	B32	B40	B41	B49	B50	B51	B52	B53	B54	B59
Durbin-Watson for Susceptible	0.61886	1.03283	0.90927	1.04783	0.95589	0.90636	1.02353	1.05763	1.05598	0.82254	0.80472	1.05794	0.77191
Durbin-Watson for Exposed	0.55069	1.23108	1.06786	1.3376	1.12609	1.13981	1.18074	1.42782	1.34177	0.69811	0.58427	1.49095	0.5303
Durbin-Watson for Infected	2.14146	1.49634	1.62048	1.86308	2.11711	2.44554	2.02021	2.54662	1.36805	1.61885	1.07182	1.32351	1.95145
Durbin-Watson for Recovered	2.65559	2.51612	2.11639	3.0028	2.84747	2.21848	2.70681	3.37546	2.87581	3.02369	2.16728	3.07463	2.96709
Auto-Correlation Test for Susceptible	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto-Correlation Test for Exposed	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto-Correlation Test for Infected	1	1	1	1	1	1	1	1	1	1	1	1	1
Auto-Correlation Test for Recovered	1	0	0	1	1	1	1	1	0	0	0	0	1

JEL	C00	C01	C02	C10	C11	C12	C13	C14	C15	C16	C18	C19	C20
Durbin-Watson for Susceptible	0.73916	1.06223	0.81463	0.74671	1.04416	0.97831	0.79749	0.78997	1.01841	0.69833	1.00954	0.72687	1.03236
Durbin-Watson for Exposed	1.24623	1.1937	0.87526	1.33883	1.69023	1.56813	1.4783	1.51723	1.55134	1.27034	1.64658	1.22927	1.71096
Durbin-Watson for Infected	1.70834	2.6932	0.82873	1.22391	2.3579	1.82529	1.74583	1.72179	1.80349	1.41382	1.28027	1.8425	2.69331
Durbin-Watson for Recovered	2.77108	2.49326	2.12917	1.34077	2.63665	3.11418	3.04166	2.1023	3.20464	2.13584	2.43632	2.66711	2.77711
Auto-Correlation Test for Susceptible	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto-Correlation Test for Exposed	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto-Correlation Test for Infected	1	1	1	0	1	1	1	1	1	1	1	1	1
Auto-Correlation Test for Recovered	0	1	0	0	1	1	1	0	1	0	0	1	1

DURBIN-WATSON STATISTICS

JEL	C21	C22	C23	C24	C25	C26	C29	C30	C31	C32	C33	C34	C35	C40	C41
Durbin-Watson for Susceptible	0.7697	0.80418	1.04334	1.04276	1.0398	0.80003	0.74837	0.76642	1.02646	0.80474	1.03546	0.75553	1.01918	0.98585	1.02449
Durbin-Watson for Exposed	1.49883	1.60648	1.6585	1.71502	1.77084	1.36588	1.29444	1.46189	1.52476	1.62666	1.70835	1.36912	1.44831	1.48272	1.63763
Durbin-Watson for Infected	0.54232	1.79909	0.75717	2.65043	1.49734	2.86451	1.91576	1.70271	1.95475	2.21513	1.61668	2.33211	1.19573	1.9641	1.7216
Durbin-Watson for Recovered	2.47362	2.81906	3.01097	3.11932	2.29819	2.22316	2.9551	2.64326	2.7238	2.95996	3.06209	2.9043	3.26446	2.06086	2.58463
Auto-Correlation Test for Susceptible	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto-Correlation Test for Exposed	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Auto-Correlation Test for Infected	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Auto-Correlation Test for Recovered	0	1	0	1	0	1	1	0	1	1	0	1	0	1	0
JEL	C43	C44	C45	C46	C49	C50	C51	C52	C53	C58	C59	C60	C61	C62	C63
Durbin-Watson for Susceptible	0.77342	0.74753	0.77073	0.69522	0.72668	0.79064	0.80358	1.0348	1.03872	1.029	0.93058	0.99633	0.86003	0.99302	0.7838
Durbin-Watson for Exposed	1.53487	0.98472	1.58677	0.86048	1.18615	1.54966	1.78208	1.70936	1.83583	1.33637	1.28584	1.56025	1.06427	1.19291	1.17922
Durbin-Watson for Infected	0.96665	1.09682	1.39718	1.55753	1.8525	1.94518	1.07928	1.94074	0.48465	2.63831	2.17702	2.22716	0.63289	0.67329	0.87552
Durbin-Watson for Recovered	2.76473	1.15217	2.97437	1.23891	2.93729	2.50874	0.83597	2.23457	2.48906	2.78572	2.79353	3.00457	1.65936	0.71035	1.26554
Auto-Correlation Test for Susceptible	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto-Correlation Test for Exposed	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0
Auto-Correlation Test for Infected	1	0	1	0	1	1	0	1	1	1	1	1	0	0	0
Auto-Correlation Test for Recovered	0	0	0	0	1	1	0	1	0	1	1	1	0	0	0
JEL	C63	C65	C67	C68	C69	C70	C71	C72	C73	C78	C79	C80	C81	C82	C83
Durbin-Watson for Susceptible	0.7838	0.81053	0.79072	0.75085	0.75788	1.0311	0.98242	1.04447	0.804	0.80269	0.74587	0.98801	0.79947	1.03275	1.02258
Durbin-Watson for Exposed	1.17922	1.55592	1.5875	1.26569	1.36378	1.68853	1.52331	1.76829	1.60402	1.60834	1.27805	1.49747	1.55011	1.65664	1.50034
Durbin-Watson for Infected	0.87552	1.35725	1.79687	1.67376	2.15007	1.76269	0.94885	1.11864	2.04157	1.2583	1.97699	1.95419	1.66165	2.28878	1.00774
Durbin-Watson for Recovered	1.26554	2.64865	2.30181	2.76634	3.07656	3.07724	1.27656	1.45957	1.96807	2.17874	2.99363	2.55653	2.453	3.01651	2.94864
Auto-Correlation Test for Susceptible	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto-Correlation Test for Exposed	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Auto-Correlation Test for Infected	0	1	1	1	1	1	0	0	1	1	1	1	1	1	1
Auto-Correlation Test for Recovered	0	0	1	0	1	1	0	0	1	0	1	1	0	1	0
JEL	C87	C88	C90	C91	C92	C93	C99	D00	D01	D02	D03	D10	D11	D12	D13
Durbin-Watson for Susceptible	0.73191	0.96552	0.77894	1.00157	1.02312	0.69531	0.74866	0.77233	1.04052	0.83724	1.00851	0.79063	0.81642	1.0587	0.80134
Durbin-Watson for Exposed	1.25484	1.42018	1.21431	1.29825	1.31061	0.93063	1.31882	0.78273	0.95823	0.66391	0.93849	0.92529	0.91881	1.01952	0.85159
Durbin-Watson for Infected	1.97678	2.05507	1.15506	0.7851	1.39122	0.85863	1.99798	2.53361	1.00292	1.68119	2.60209	1.86223	1.80135	0.80497	1.85652
Durbin-Watson for Recovered	2.67547	2.43567	1.63348	1.79282	1.97132	2.96238	3.00091	2.65406	2.18313	2.70801	2.6637	1.80954	2.83478	1.17997	1.60895
Auto-Correlation Test for Susceptible	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto-Correlation Test for Exposed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto-Correlation Test for Infected	1	1	0	1	1	1	1	1	1	1	1	1	1	0	0
Auto-Correlation Test for Recovered	1	1	0	0	0	0	1	1	0	0	1	1	1	0	1

DURBIN-WATSON STATISTICS

JEL	D14	D18	D19	D20	D21	D22	D23	D24	D29	D30	D31	D33	D39	D40	D41
Durbin-Watson for Susceptible	0.8288	0.79886	0.78281	0.77756	0.81418	1.02392	1.07089	0.78476	1.00445	1.0027	1.03804	1.00056	1.00445	1.05973	1.03164
Durbin-Watson for Exposed	0.78842	0.90229	0.84994	0.81053	0.92085	0.94511	0.96209	0.90945	0.95171	0.94139	1.01208	0.95816	0.95162	1.09787	0.97711
Durbin-Watson for Infected	0.51074	1.56999	1.98955	1.9859	1.50474	2.75457	1.05582	0.37354	1.98106	1.93066	1.12151	2.4412	1.98105	1.98125	2.58652
Durbin-Watson for Recovered	2.51163	2.69608	2.87503	2.63504	1.84177	3.16541	1.49009	1.36745	3.02319	1.92561	2.44918	2.74695	3.02318	3.28102	2.82454
Auto-Correlation Test for Susceptible	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto-Correlation Test for Exposed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto-Correlation Test for Infected	1	1	1	1	1	1	0	0	1	1	1	1	1	1	1
Auto-Correlation Test for Recovered	0	0	1	1	0	1	0	0	1	1	0	1	1	1	1
JEL	D42	D43	D44	D45	D46	D49	D50	D50	D52	D53	D57	D58	D59	D60	D61
Durbin-Watson for Susceptible	1.04255	1.06079	0.74647	1.02962	0.99413	0.78431	0.80094	0.80094	0.77091	0.81893	0.80867	0.78254	0.7801	0.80111	1.02991
Durbin-Watson for Exposed	1.00637	1.04623	0.80548	0.98472	0.92857	0.80604	0.872	0.872	0.79999	0.78484	0.894	0.8371	0.84497	0.88632	1.03115
Durbin-Watson for Infected	0.84677	1.81824	1.10148	1.8117	2.66652	1.94477	2.19539	2.19539	3.37008	0.62439	2.59012	2.21876	1.57088	1.90865	1.9361
Durbin-Watson for Recovered	2.15432	2.33887	2.73096	2.28215	3.06612	2.92669	2.73808	2.73808	3.60151	1.14263	2.83284	2.15593	2.28493	2.41406	2.36883
Auto-Correlation Test for Susceptible	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto-Correlation Test for Exposed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto-Correlation Test for Infected	1	1	1	1	1	1	1	1	0	0	1	1	1	1	1
Auto-Correlation Test for Recovered	0	1	0	1	1	1	1	1	1	0	1	1	0	1	1
JEL	D62	D63	D64	D69	D70	D72	D73	D74	D78	D79	D80	D81	D82	D83	D84
Durbin-Watson for Susceptible	1.05133	0.81606	0.81615	1.00604	0.77083	1.06898	0.7967	1.06172	1.01087	1.01049	0.94108	0.79349	0.80305	0.71062	1.05836
Durbin-Watson for Exposed	1.01872	0.89987	0.87675	0.94351	0.78361	1.09791	0.81975	1.01631	0.94866	0.99568	0.87386	0.86291	0.87243	0.76857	1.04835
Durbin-Watson for Infected	2.78855	2.11451	1.22646	2.07654	1.95101	0.83446	0.78327	1.35234	1.55027	2.0562	1.95353	0.63852	0.79761	0.54225	2.82815
Durbin-Watson for Recovered	3.25989	2.49633	2.17273	3.01482	2.73233	1.12557	2.45887	2.272	1.2973	2.83736	2.41929	2.12747	1.61124	2.59835	3.10207
Auto-Correlation Test for Susceptible	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto-Correlation Test for Exposed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto-Correlation Test for Infected	1	1	1	1	1	0	1	1	0	1	1	1	0	1	1
Auto-Correlation Test for Recovered	1	1	0	1	1	0	0	0	0	1	1	0	0	0	1
JEL	D85	D86	D87	D90	D91	D92	D99	E00	E01	E02	E10	E11	E12	E13	E17
Durbin-Watson for Susceptible	1.07637	0.82794	1.07149	1.00674	1.01324	0.80723	1.0026	1.05699	1.02443	0.83466	1.06106	0.81846	1.0152	1.0626	0.81939
Durbin-Watson for Exposed	0.8308	0.71408	0.84855	0.9615	0.94885	0.84171	0.9287	1.0212	1.02425	0.6568	1.10076	0.9355	0.98899	1.01355	0.94006
Durbin-Watson for Infected	2.02429	0.43146	2.6538	1.83969	2.18898	0.68359	1.99984	2.49994	1.23775	0.98073	1.9519	2.44936	1.20838	1.0617	2.1593
Durbin-Watson for Recovered	2.7827	0.64612	3.1238	2.12644	2.86062	1.60156	3.01258	3.07932	1.68914	1.00571	2.41229	2.91377	2.09284	2.54248	2.08189
Auto-Correlation Test for Susceptible	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto-Correlation Test for Exposed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto-Correlation Test for Infected	1	0	1	1	1	0	1	1	0	0	1	1	1	1	1
Auto-Correlation Test for Recovered	1	0	1	1	1	0	1	1	0	0	1	1	0	0	1

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JEL	E19	E20	E21	E22	E23	E24	E25	E26	E27	E29	E30	E31	E32	E37	E39
Durbin-Watson for Susceptible	0.81488	1.05285	0.80975	1.05756	0.8306	1.03819	1.06345	0.82004	1.07086	1.05706	1.05922	0.81084	0.81628	0.79851	1.05404
Durbin-Watson for Exposed	0.92397	1.16437	0.90789	1.06911	0.69086	1.06312	1.07645	0.88458	0.9959	1.03417	1.10183	0.94867	0.84322	0.89247	1.01662
Durbin-Watson for Infected	1.91958	2.1569	1.21851	1.49569	0.86049	1.28534	1.29005	1.38897	0.84946	1.95792	2.01177	0.67083	1.23536	0.70545	2.00661
Durbin-Watson for Recovered	2.47516	2.83898	2.11904	3.10613	0.84688	1.64136	2.41079	2.579	2.55392	2.99914	2.31485	2.43122	1.08883	2.46991	2.97246
Auto-Correlation Test for Susceptible	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto-Correlation Test for Exposed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto-Correlation Test for Infected	1	1	1	1	0	0	1	1	1	1	1	1	0	1	1
Auto-Correlation Test for Recovered	1	1	0	0	0	0	0	0	0	1	1	0	0	0	1
JEL	E40	E42	E43	E44	E47	E49	E50	E51	E52	E58	E60	E61	E62	E63	E64
Durbin-Watson for Susceptible	0.72013	0.81956	0.81303	0.7965	1.03366	1.0577	1.06144	1.0639	0.75349	0.8129	1.05816	1.06712	1.06189	1.06372	0.81768
Durbin-Watson for Exposed	0.8722	0.90967	0.92597	0.74162	0.92525	1.03123	1.04977	1.11115	0.89209	0.90755	1.02947	1.04443	1.08768	1.03194	0.90659
Durbin-Watson for Infected	2.37987	2.32023	0.68614	0.94245	1.16976	2.00092	3.0522	2.89773	0.52613	0.89922	2.43833	2.6792	1.46853	3.37179	2.7156
Durbin-Watson for Recovered	3.10028	3.17305	2.54318	1.16943	3.02639	3.00301	2.15464	2.89928	0.72963	1.18778	2.80343	3.11792	2.09033	2.75467	3.06175
Auto-Correlation Test for Susceptible	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto-Correlation Test for Exposed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto-Correlation Test for Infected	1	1	1	0	1	1	1	1	0	0	1	1	1	1	1
Auto-Correlation Test for Recovered	1	1	0	0	0	1	1	1	0	0	1	1	0	1	1
JEL	E65	E66	F00	F01	F02	F10	F11	F12	F13	F14	F15	F16	F17	F18	F19
Durbin-Watson for Susceptible	0.8204	0.80021	1.05684	0.78854	0.90331	0.80554	0.55989	0.59463	0.83426	0.83426	1.05795	0.76734	1.04329	0.82943	1.06116
Durbin-Watson for Exposed	0.91059	0.79927	1.02001	0.7002	0.92196	0.68309	0.56493	0.61903	0.92488	0.66649	0.98309	0.68197	0.97967	0.65951	0.99859
Durbin-Watson for Infected	2.05361	2.21733	2.59007	2.04322	1.8801	1.65199	2.3732	3.28134	0.93285	0.66664	1.12041	1.45168	2.62419	1.19028	2.00138
Durbin-Watson for Recovered	2.67965	2.70707	2.75522	2.94656	2.32411	2.22868	2.91753	2.64147	2.45204	1.20167	2.88071	2.31989	2.98509	1.62403	2.85014
Auto-Correlation Test for Susceptible	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto-Correlation Test for Exposed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto-Correlation Test for Infected	1	1	1	1	1	1	1	1	1	0	1	1	1	0	1
Auto-Correlation Test for Recovered	1	1	1	1	1	0	1	1	0	0	0	0	1	0	1
JEL	F20	F21	F22	F23	F24	F29	F30	F31	F32	F33	F34	F35	F36	F37	F39
Durbin-Watson for Susceptible	0.79508	0.9738	0.73413	1.06374	0.82547	0.80952	0.7843	0.92114	0.96818	0.80004	0.90472	0.83254	0.81529	1.0591	0.81279
Durbin-Watson for Exposed	0.76708	0.96582	0.64634	0.98766	0.75439	0.91953	0.69809	0.95049	0.91312	0.62546	0.87082	0.66005	0.81868	1.01188	0.74124
Durbin-Watson for Infected	2.3709	2.73662	1.70145	1.1499	1.5816	#######	2.08919	0.93182	1.79302	1.14686	2.07356	1.10031	1.69697	0.88674	1.64238
Durbin-Watson for Recovered	2.76582	2.64342	2.76069	2.03583	1.66738	#######	2.88383	2.06445	3.22388	1.41007	2.95517	3.36164	1.62964	2.50961	2.93308
Auto-Correlation Test for Susceptible	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto-Correlation Test for Exposed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto-Correlation Test for Infected	1	1	1	1	0	0	1	1	1	0	1	1	0	1	1
Auto-Correlation Test for Recovered	1	1	0	0	0	0	1	0	1	0	1	0	0	0	0

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JEL	F40	F41	F42	F43	F47	F50	F51	F52	F53	F54	F55	F59	G00	G01	G10
Durbin-Watson for Susceptible	1.06101	0.60733	0.92352	0.90526	1.0516	1.03606	1.02998	1.05049	1.02578	0.7955	0.82269	1.06497	0.99712	1.0281	1.01957
Durbin-Watson for Exposed	1.02124	0.62999	0.95137	0.86116	0.96587	1.12781	1.12855	1.14051	1.14311	0.72806	0.80023	0.98387	1.21751	1.08708	1.27558
Durbin-Watson for Infected	1.04883	2.92835	2.21433	2.16668	1.3841	1.03245	1.10962	1.25142	2.07463	1.16498	1.4502	2.04511	2.47699	2.06981	1.60757
Durbin-Watson for Recovered	2.33142	2.78425	2.6948	1.63829	2.83609	2.50892	1.6044	1.64121	3.12565	1.36408	3.14039	3.01433	2.82216	2.07043	1.65248
Auto-Correlation Test for Susceptible	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto-Correlation Test for Exposed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto-Correlation Test for Infected	1	1	1	0	1	1	0	0	1	0	1	1	1	1	0
Auto-Correlation Test for Recovered	0	1	1	1	0	0	0	0	1	0	0	1	1	1	0
JEL	G11	G12	G13	G14	G15	G17	G18	G19	G20	G21	G22	G23	G24	G28	G29
Durbin-Watson for Susceptible	1.01643	0.79779	1.0319	0.79013	1.03648	1.06339	0.9945	0.76953	0.79237	0.78723	1.0209	0.74472	0.79679	0.72452	0.76914
Durbin-Watson for Exposed	1.26896	1.06804	1.35503	1.15478	1.27125	1.00209	1.23582	1.02475	1.05651	1.10625	1.32277	0.9482	1.00843	0.91072	1.00969
Durbin-Watson for Infected	0.73185	1.14598	1.41483	0.89651	1.94245	1.2393	0.95403	2.61757	1.68527	0.91944	1.2575	0.73332	1.37111	0.72862	1.99623
Durbin-Watson for Recovered	1.24195	0.70826	1.94439	1.97138	2.2568	1.26622	2.18344	2.96914	1.85262	0.83313	2.57679	1.10583	2.38594	0.65426	2.93748
Auto-Correlation Test for Susceptible	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto-Correlation Test for Exposed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto-Correlation Test for Infected	0	0	1	1	1	0	1	1	1	0	1	0	1	0	1
Auto-Correlation Test for Recovered	0	0	0	0	1	0	0	1	0	0	0	0	0	0	1
JEL	G30	G31	G32	G33	G34	G35	G38	G39	H00	H10	H11	H12	H20	H21	H22
Durbin-Watson for Susceptible	0.75162	1.03903	0.79086	0.80074	0.79831	0.77146	0.78624	0.77129	0.81424	1.05035	0.79399	0.8194	0.80492	1.05757	1.06069
Durbin-Watson for Exposed	0.93845	1.30316	1.08713	1.06454	1.11666	0.98751	1.06025	1.01849	0.91037	1.04682	0.89056	0.86762	0.83556	1.1306	1.04993
Durbin-Watson for Infected	1.6208	0.92574	0.65748	1.96112	0.66074	1.24594	1.35302	1.9963	1.85442	2.18255	0.67951	2.76372	1.53749	3.22335	2.50485
Durbin-Watson for Recovered	1.84269	2.69815	0.70402	2.50483	2.46487	2.32083	2.36136	3.04938	2.83961	2.83189	2.46488	2.47028	2.6876	2.70554	2.96802
Auto-Correlation Test for Susceptible	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto-Correlation Test for Exposed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto-Correlation Test for Infected	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1
Auto-Correlation Test for Recovered	0	0	0	1	0	0	0	1	1	1	0	1	0	1	1
JEL	H23	H24	H25	H26	H27	H29	H30	H31	H32	H39	H40	H41	H42	H43	H44
Durbin-Watson for Susceptible	1.05406	1.02678	0.79076	0.79953	0.81719	0.81465	0.81613	0.80918	0.80874	0.81254	1.05593	0.77861	0.81965	0.81188	1.06301
Durbin-Watson for Exposed	0.99012	1.06236	0.83358	0.84305	0.86601	0.90643	0.89193	0.90095	0.87573	0.86491	1.03144	0.85626	0.89382	0.9463	0.98946
Durbin-Watson for Infected	1.87341	1.33788	0.95293	1.4451	1.8766	1.87437	2.4032	2.58879	1.24133	1.95875	1.54724	2.13821	1.90857	1.54073	1.25417
Durbin-Watson for Recovered	2.6447	2.39631	2.58679	1.93639	2.86665	2.98904	2.95432	3.10528	2.13058	2.94126	2.12568	2.66182	2.68972	1.8633	1.33258
Auto-Correlation Test for Susceptible	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto-Correlation Test for Exposed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto-Correlation Test for Infected	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0
Auto-Correlation Test for Recovered	1	0	0	0	1	1	1	1	0	1	0	1	1	0	0

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JEL	H50	H51	H52	H53	H54	H55	H56	H57	H59	H60	H61	H62	H63	H68	H70
Durbin-Watson for Susceptible	1.02314	1.06308	1.05227	1.0602	0.81254	1.05543	0.98633	0.80861	1.04999	1.05218	0.82095	0.76223	0.76704	1.05065	0.81889
Durbin-Watson for Exposed	1.03002	1.06792	1.0088	1.08297	0.92572	1.05977	1.01117	0.85055	1.06465	1.0432	0.91719	0.80595	0.79831	1.0322	0.86497
Durbin-Watson for Infected	0.67446	0.71816	0.68743	2.78932	0.85604	1.79659	0.91299	1.9335	1.93681	1.61792	1.34706	1.7848	1.82384	1.51433	1.94673
Durbin-Watson for Recovered	2.61082	2.44861	1.83489	2.532	2.88095	2.95277	2.62124	1.83409	2.27447	2.01615	3.48466	2.66122	2.83533	2.05172	3.08128
Auto-Correlation Test for Susceptible	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto-Correlation Test for Exposed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto-Correlation Test for Infected	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1
Auto-Correlation Test for Recovered	0	0	0	1	0	1	0	1	1	0	0	1	1	0	1
JEL	H71	H72	H73	H74	H75	H76	H77	H79	H80	H81	H82	H83	H87	H89	I00
Durbin-Watson for Susceptible	1.04521	0.8096	1.05718	0.80992	0.81694	0.82393	0.80873	0.81498	1.04986	1.0538	1.06038	1.0444	1.06036	0.8137	1.06321
Durbin-Watson for Exposed	1.04802	0.89506	1.12873	0.79138	0.8734	0.8087	0.9155	0.86122	1.02673	1.05047	1.01361	1.06434	1.06314	0.88921	0.99755
Durbin-Watson for Infected	1.46072	1.86027	1.96134	2.11268	0.66595	0.84291	1.70704	0.90142	1.99784	1.53824	2.25522	1.37884	2.26751	1.96339	2.12063
Durbin-Watson for Recovered	2.44907	2.49246	2.4735	2.70002	2.966	2.56989	3.59615	1.71543	2.97846	2.45164	2.89688	2.67575	2.06796	2.97603	2.09764
Auto-Correlation Test for Susceptible	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto-Correlation Test for Exposed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto-Correlation Test for Infected	1	1	1	1	1	1	0	0	1	1	1	1	1	1	1
Auto-Correlation Test for Recovered	0	1	1	1	0	0	0	0	1	0	1	0	1	1	1
JEL	I10	I11	I12	I18	I19	I20	I21	I22	I23	I28	I29	I30	I31	I32	I38
Durbin-Watson for Susceptible	1.06716	0.79594	1.05456	1.02867	0.81614	0.79165	1.03271	0.74822	0.83417	0.82786	1.06325	0.75929	1.06789	0.76341	1.03921
Durbin-Watson for Exposed	0.99147	0.69306	1.02905	1.04431	0.67767	0.76847	1.09358	0.75564	0.60909	0.71415	1.04805	0.70336	1.01739	0.59757	1.00992
Durbin-Watson for Infected	0.73307	0.88813	0.95684	0.94049	2.30735	1.04929	0.67311	1.81693	1.65525	0.80799	2.01978	1.2114	0.99496	1.15409	1.25913
Durbin-Watson for Recovered	2.67229	1.49564	1.64438	2.51542	3.00093	2.44005	2.12937	2.16079	1.35757	2.88779	2.98536	2.12382	2.52078	2.56609	2.22842
Auto-Correlation Test for Susceptible	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto-Correlation Test for Exposed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto-Correlation Test for Infected	1	0	0	1	1	1	1	1	0	1	1	1	1	1	1
Auto-Correlation Test for Recovered	0	0	0	0	1	0	0	1	0	0	1	0	0	0	0
JEL	I39	J00	J01	J08	J10	J11	J12	J13	J14	J15	J15	J16	J17	J18	J19
Durbin-Watson for Susceptible	1.05942	1.02854	1.03573	0.99745	0.79099	0.81348	0.80383	0.78458	1.00578	0.94323	0.94323	0.77279	0.72091	0.66036	1.04124
Durbin-Watson for Exposed	1.02973	1.36947	1.17518	1.32713	0.98064	0.84792	0.77561	0.82332	1.15566	1.14366	1.14366	0.76864	0.9496	0.77136	1.21599
Durbin-Watson for Infected	1.97949	2.42585	0.99617	0.84675	1.97645	0.97969	1.63312	1.35284	2.11235	1.76169	1.76169	1.37419	2.28335	1.7847	1.87135
Durbin-Watson for Recovered	2.99303	2.36482	1.60107	1.32835	2.06576	2.42642	2.43657	2.07938	2.65347	2.44132	2.44132	1.7415	2.44875	2.49995	2.99175
Auto-Correlation Test for Susceptible	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto-Correlation Test for Exposed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto-Correlation Test for Infected	1	1	0	0	1	1	1	1	1	1	1	1	1	1	1
Auto-Correlation Test for Recovered	1	1	0	0	1	0	0	0	1	1	1	0	1	1	1

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JEL	J20	J21	J22	J23	J24	J26	J28	J29	J30	J31	J32	J33	J38	J39	J40
Durbin-Watson for Susceptible	1.01811	0.88588	1.04572	1.02645	0.78712	0.7872	0.79566	1.04542	0.75689	0.76343	0.94236	0.71837	0.66569	1.04322	0.78263
Durbin-Watson for Exposed	1.3661	1.21863	1.22446	1.20033	0.81986	0.82872	0.79497	1.21907	1.06761	0.83273	1.09226	0.86465	0.80787	1.24912	1.00604
Durbin-Watson for Infected	2.88604	3.02159	1.3717	2.10505	1.21278	1.17912	1.86493	1.49243	2.20945	0.91235	1.92458	1.75168	1.95692	2.02363	2.39118
Durbin-Watson for Recovered	2.779	2.33059	2.535	2.97821	3.25634	1.6483	3.4558	2.57033	2.66047	2.50983	2.18701	2.15634	2.15261	3.00787	2.83047
Auto-Correlation Test for Susceptible	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto-Correlation Test for Exposed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto-Correlation Test for Infected	1	1	1	1	1	0	0	1	1	1	1	1	1	1	1
Auto-Correlation Test for Recovered	1	1	0	1	0	0	1	0	1	0	1	1	1	1	1
JEL	J41	J42	J43	J44	J45	J48	J49	J50	J51	J52	J53	J54	J58	J59	J60
Durbin-Watson for Susceptible	0.649	0.8735	0.93409	1.02849	0.74004	1.04581	1.03368	0.92069	0.88095	0.93871	0.6687	0.75817	0.9218	0.81939	0.96837
Durbin-Watson for Exposed	0.84064	1.03489	1.19288	1.1816	0.67352	1.22391	1.24354	1.25335	1.25325	1.17044	0.90956	0.96182	1.41622	0.85544	1.39209
Durbin-Watson for Infected	2.54115	2.15883	2.51658	1.39706	1.92898	2.24318	1.69929	2.20114	1.99407	1.82291	2.12836	2.11957	2.64068	1.99916	2.30098
Durbin-Watson for Recovered	2.28162	2.98943	2.94851	2.44292	2.63193	2.98967	2.60801	2.69531	2.27979	2.30048	2.23205	2.48045	2.81125	2.99033	3.04921
Auto-Correlation Test for Susceptible	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto-Correlation Test for Exposed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto-Correlation Test for Infected	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Auto-Correlation Test for Recovered	1	1	1	0	1	1	0	1	1	1	1	1	1	1	1
JEL	J61	J62	J63	J64	J65	J68	J69	J70	J71	J78	J80	J81	J82	J83	J88
Durbin-Watson for Susceptible	0.78298	1.0276	0.79029	0.84318	0.69946	0.64133	0.81953	1.0327	0.91995	0.73364	0.81342	1.04365	0.73956	0.98778	0.80427
Durbin-Watson for Exposed	0.79298	1.24281	0.83832	1.18522	0.80452	0.75824	0.80049	1.32498	1.25446	1.02942	0.83904	1.26535	0.82445	1.35788	0.84503
Durbin-Watson for Infected	1.9862	2.50733	2.84281	2.52153	2.55765	2.25498	2.08055	1.76524	2.22803	2.27753	0.97642	2.97769	1.35217	2.33383	1.87071
Durbin-Watson for Recovered	3.28125	3.21645	2.82883	2.1897	2.64161	2.60541	2.89126	2.44769	2.08215	3.06876	1.63052	3.32494	2.10795	3.19474	2.78199
Auto-Correlation Test for Susceptible	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto-Correlation Test for Exposed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto-Correlation Test for Infected	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1
Auto-Correlation Test for Recovered	1	1	1	1	1	1	1	1	1	1	0	1	0	1	1
JEL	J89	K00	K10	K11	K12	K13	K14	K19	K20	K21	K22	K23	K29	K30	K31
Durbin-Watson for Susceptible	1.04419	0.79803	1.06036	0.76259	1.06135	0.78658	1.06118	0.8105	1.05889	0.98721	0.78035	1.06114	0.81846	0.81676	0.77465
Durbin-Watson for Exposed	1.24912	0.99405	1.03551	0.85464	1.02283	0.89691	1.00769	0.99062	1.10549	1.14122	1.14987	1.03174	1.01291	1.03521	1.00796
Durbin-Watson for Infected	2.01291	1.5587	1.93224	1.04378	2.58486	2.25364	1.95266	1.97636	1.61314	0.50344	1.02812	1.67024	1.86168	1.97396	1.22104
Durbin-Watson for Recovered	2.98686	1.49198	2.78982	1.93035	3.02317	2.63957	2.52901	2.52681	1.99236	2.13156	2.21399	2.55447	2.61741	2.72031	2.96077
Auto-Correlation Test for Susceptible	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto-Correlation Test for Exposed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto-Correlation Test for Infected	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1
Auto-Correlation Test for Recovered	1	0	1	0	1	1	1	1	0	0	0	0	1	1	0

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JEL	K32	K33	K34	K35	K36	K39	K40	K41	K42	K49	L00	L10	L11	L13	L14
Durbin-Watson for Susceptible	1.04436	1.03932	1.05604	0.81027	1.05997	0.8166	1.05737	1.06065	1.02734	1.03879	0.82121	1.06972	0.77761	0.81746	0.84355
Durbin-Watson for Exposed	0.91519	1.01353	1.04983	1.00516	1.07637	1.01997	1.01119	0.99121	1.11752	0.91555	0.67866	0.78986	0.74808	0.78491	0.71179
Durbin-Watson for Infected	1.712	1.4219	1.63598	2.15357	1.42122	2.0486	1.2555	2.14586	0.95373	1.82937	1.9733	1.7523	0.94003	0.92725	0.56045
Durbin-Watson for Recovered	2.48312	3.22163	2.54876	3.14546	1.99971	2.86274	2.04177	2.58415	2.32986	2.85139	2.72994	3.04507	2.08242	1.63427	1.67032
Auto-Correlation Test for Susceptible	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto-Correlation Test for Exposed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto-Correlation Test for Infected	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0
Auto-Correlation Test for Recovered	0	0	0	1	0	1	0	1	0	1	1	1	0	0	0
JEL	L15	L16	L17	L19	L20	L21	L22	L23	L24	L25	L26	L29	L30	L31	L32
Durbin-Watson for Susceptible	0.81744	1.05226	0.83429	1.07565	1.06897	0.84666	0.82678	0.83758	0.82704	1.11172	0.83292	1.0776	1.07256	0.82941	1.08835
Durbin-Watson for Exposed	0.70262	0.76932	0.68608	0.80268	0.78823	0.80505	0.71333	0.72405	0.64614	0.90836	0.7255	0.80848	0.77053	0.74935	0.75928
Durbin-Watson for Infected	2.3412	2.51519	1.3613	1.96683	1.8486	0.52969	2.5618	0.68392	0.92994	0.49287	0.9789	2.0054	2.29346	1.10427	1.62045
Durbin-Watson for Recovered	2.67722	3.01881	3.43036	2.98585	2.31337	1.95764	2.71706	1.6145	2.96857	1.66228	2.75769	2.96942	3.14911	3.51418	3.32479
Auto-Correlation Test for Susceptible	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto-Correlation Test for Exposed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto-Correlation Test for Infected	1	1	0	1	1	1	1	0	1	0	1	1	1	0	1
Auto-Correlation Test for Recovered	1	1	0	1	1	0	1	0	0	0	0	1	1	0	0
JEL	L33	L38	L40	L41	L42	L43	L44	L49	L50	L51	L52	L53	L59	L60	L61
Durbin-Watson for Susceptible	1.06915	1.07672	0.97143	0.80455	1.05838	0.81606	1.06066	1.07342	0.819	1.07257	1.09614	1.10427	0.82144	0.78466	0.79881
Durbin-Watson for Exposed	0.87112	0.79609	0.79006	0.66599	0.76705	0.69737	0.8154	0.80102	0.68951	0.80247	0.82783	0.72055	0.71563	0.70324	0.69331
Durbin-Watson for Infected	3.03634	1.85514	0.54378	2.28242	2.52918	2.34702	2.03253	1.95387	2.11959	1.58347	1.1286	1.74317	1.75428	1.94947	1.85697
Durbin-Watson for Recovered	3.04536	2.46363	2.74428	2.43736	3.06259	2.45256	2.19318	3.02794	2.9405	2.76301	2.0525	2.78213	2.63318	2.98158	2.79368
Auto-Correlation Test for Susceptible	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto-Correlation Test for Exposed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto-Correlation Test for Infected	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Auto-Correlation Test for Recovered	1	1	0	1	1	1	1	1	1	0	0	1	1	1	1
JEL	L62	L63	L64	L65	L66	L67	L68	L69	L70	L71	L72	L73	L74	L78	L79
Durbin-Watson for Susceptible	0.83848	0.88858	1.00735	0.90117	1.0996	0.79555	0.96295	1.03364	0.81903	0.83536	0.96225	0.83087	1.09155	0.79007	0.82199
Durbin-Watson for Exposed	0.71886	0.69554	0.77706	0.66767	0.81832	0.74408	0.78103	0.82579	0.70396	0.74358	0.71301	0.73052	0.84434	0.81058	0.71571
Durbin-Watson for Infected	1.23866	1.1593	0.9784	1.49698	0.69138	0.9079	1.71487	1.08635	1.8969	1.30314	1.8222	2.02046	1.98026	1.49639	1.97229
Durbin-Watson for Recovered	1.96368	2.29063	2.11326	3.3861	1.93769	2.39889	2.37876	1.88076	2.80631	2.64682	2.92982	3.16387	2.91788	2.07917	3.00261
Auto-Correlation Test for Susceptible	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto-Correlation Test for Exposed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto-Correlation Test for Infected	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Auto-Correlation Test for Recovered	0	0	0	0	0	0	0	0	1	0	1	1	1	0	1

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JEL	L80	L81	L82	L83	L84	L85	L86	L87	L88	L89	L90	L91	L92	L93	L94
Durbin-Watson for Susceptible	1.08213	0.76392	1.05884	0.83829	1.07161	1.05787	0.80017	0.81924	0.80244	0.82409	0.81455	1.05873	1.10206	1.09451	0.83451
Durbin-Watson for Exposed	0.81216	0.65502	0.76463	0.72585	0.69504	0.77725	0.78596	0.72126	0.64559	0.74577	0.68959	0.8048	0.80195	0.81611	0.74699
Durbin-Watson for Infected	1.81744	0.79497	0.63771	0.78304	1.81925	1.64747	0.96242	1.02917	1.46876	2.11795	2.28596	1.84519	0.77397	1.32273	1.46247
Durbin-Watson for Recovered	2.32232	2.67094	1.99183	2.32857	3.4347	2.70356	1.40189	3.0947	1.70721	3.1188	2.88645	3.19909	1.79342	2.86449	2.66882
Auto-Correlation Test for Susceptible	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto-Correlation Test for Exposed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto-Correlation Test for Infected	1	1	1	1	0	1	0	1	0	1	1	1	1	1	1
Auto-Correlation Test for Recovered	1	0	0	0	1	0	0	0	0	1	1	1	0	0	0
JEL	L95	L96	L97	L98	L99	M00	M10	M11	M12	M13	M14	M15	M19	M20	M21
Durbin-Watson for Susceptible	0.8088	1.09152	1.09741	0.78689	0.78067	0.92988	1.02305	0.98839	1.02489	0.79891	0.78554	0.81017	0.91188	0.92761	0.87291
Durbin-Watson for Exposed	0.71568	0.84137	0.78675	0.73096	0.90574	1.27255	1.20937	1.08819	1.46535	1.3851	1.2446	0.95133	1.22126	1.26183	1.09216
Durbin-Watson for Infected	0.88314	1.55977	2.09657	0.81343	1.3731	1.79201	0.92669	0.88598	0.87961	0.79262	0.74262	0.70517	2.16075	1.59158	2.19075
Durbin-Watson for Recovered	2.14813	2.99065	3.38112	2.82657	1.91725	2.52877	3.06779	0.95428	2.15992	1.46772	3.06139	2.94378	3.03636	2.16682	2.30308
Auto-Correlation Test for Susceptible	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto-Correlation Test for Exposed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto-Correlation Test for Infected	1	1	1	1	1	1	1	0	1	0	1	1	1	1	1
Auto-Correlation Test for Recovered	0	0	1	0	0	1	0	0	0	0	0	0	1	0	1
JEL	M29	M30	M31	M37	M38	M39	M40	M41	M42	M48	M49	M50	M51	M52	M53
Durbin-Watson for Susceptible	0.93189	0.92961	1.04072	0.79363	0.74211	0.938	0.92871	0.80637	1.0571	0.80689	0.92079	1.02916	1.02511	0.80831	1.05049
Durbin-Watson for Exposed	1.27752	1.30977	1.5038	1.34901	1.11922	1.30988	1.32867	1.39943	1.16182	0.89696	1.25489	1.38354	1.36159	1.28411	1.4998
Durbin-Watson for Infected	1.99661	2.07482	1.17932	0.86841	0.86285	1.96218	1.40779	1.17049	1.14547	1.07569	1.94122	2.14219	2.03431	0.47029	0.90951
Durbin-Watson for Recovered	3.00101	2.11355	1.86248	2.74332	1.88526	2.98143	2.02348	2.12558	1.77109	3.40534	2.95128	3.3562	3.00294	1.74627	2.37604
Auto-Correlation Test for Susceptible	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto-Correlation Test for Exposed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto-Correlation Test for Infected	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1
Auto-Correlation Test for Recovered	1	1	0	0	0	1	0	0	0	0	1	1	1	0	0
JEL	M54	M55	M59	N00	N01	N10	N11	N12	N13	N14	N15	N16	N17	N20	N21
Durbin-Watson for Susceptible	1.0362	1.00008	0.90937	1.04438	0.99627	1.04402	1.01093	0.73015	0.69937	0.90949	1.03642	0.8109	0.97647	0.77423	0.98555
Durbin-Watson for Exposed	1.31704	1.37206	1.25137	1.40067	1.36754	1.24096	1.2936	0.53595	0.53627	1.25808	1.24872	0.56321	1.43127	0.55731	1.31921
Durbin-Watson for Infected	1.06025	1.7907	2.2464	2.06904	2.09396	1.87696	2.23468	2.92355	2.10594	2.35701	1.86543	1.8588	1.89803	1.76809	2.41666
Durbin-Watson for Recovered	2.39207	2.81644	2.9192	2.97748	2.60037	2.86028	2.13734	2.8008	2.81519	3.00817	1.8867	3.13355	2.82298	1.97189	2.7999
Auto-Correlation Test for Susceptible	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto-Correlation Test for Exposed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto-Correlation Test for Infected	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Auto-Correlation Test for Recovered	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1

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JEL	N22	N23	N24	N25	N26	N27	N30	N31	N32	N33	N34	N35	N36	N40	N41
Durbin-Watson for Susceptible	0.95748	1.02268	0.77197	0.78171	0.79396	0.76552	0.80509	0.9143	0.84879	1.00608	1.0202	0.8005	0.82574	1.0587	0.81203
Durbin-Watson for Exposed	1.2739	1.24487	0.57443	0.58417	0.54385	0.63534	0.59525	1.18208	1.08329	1.23258	1.17953	0.56178	0.58752	1.25184	0.60761
Durbin-Watson for Infected	2.9714	1.91153	1.67553	1.32879	2.33182	2.76558	2.59434	3.31772	3.54646	1.96186	1.57185	1.19455	1.14715	1.12479	1.40901
Durbin-Watson for Recovered	2.65295	2.17024	2.59922	1.87036	2.83663	3.27659	3.16826	2.22108	2.59091	2.77256	2.14397	2.51897	3.10381	2.05633	2.34669
Auto-Correlation Test for Susceptible	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto-Correlation Test for Exposed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto-Correlation Test for Infected	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Auto-Correlation Test for Recovered	1	1	0	0	1	1	1	1	0	1	0	0	0	0	0
JEL	N42	N43	N44	N45	N46	N47	N50	N51	N52	N53	N54	N55	N56	N57	N60
Durbin-Watson for Susceptible	1.0485	0.78964	1.02365	0.81375	1.05942	0.81721	0.81293	1.00709	0.74373	0.99072	0.77258	0.66337	1.01565	0.81028	1.05676
Durbin-Watson for Exposed	1.25855	0.55552	1.25981	0.58059	1.28274	0.59181	0.58605	1.24581	0.50474	1.18506	0.5219	0.61476	1.27401	0.56903	1.20795
Durbin-Watson for Infected	1.19323	2.0535	1.53396	1.6046	1.37651	1.29035	1.28815	2.30555	2.2988	2.27993	2.49389	2.42505	2.41562	2.12293	1.25657
Durbin-Watson for Recovered	2.06591	3.1721	2.77152	3.29138	1.86561	2.30752	2.28504	3.09594	2.79112	3.08796	3.19774	2.98444	2.99312	2.98535	2.16806
Auto-Correlation Test for Susceptible	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto-Correlation Test for Exposed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto-Correlation Test for Infected	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Auto-Correlation Test for Recovered	0	1	0	0	0	0	0	1	1	1	1	1	1	1	0
JEL	N61	N62	N63	N64	N65	N66	N67	N70	N71	N72	N73	N74	N75	N76	N77
Durbin-Watson for Susceptible	0.9907	0.70018	0.83562	0.70493	1.00958	1.03876	1.02314	1.05245	0.71341	1.05431	0.80071	1.0465	0.94664	0.81056	0.92191
Durbin-Watson for Exposed	1.35169	0.61251	1.07446	0.56878	1.18539	1.25195	1.32873	1.20121	0.58795	1.21591	0.57748	1.2756	1.08936	0.57631	1.24425
Durbin-Watson for Infected	3.29808	2.50236	3.182	2.49369	2.33288	1.5465	2.73657	1.74649	2.16925	2.26525	1.75403	1.89767	1.80079	1.69268	2.74099
Durbin-Watson for Recovered	3.22304	3.12913	2.78906	2.51663	3.11645	2.47795	2.83679	2.04827	2.9238	2.461	2.36218	2.66316	2.34674	2.76207	3.29204
Auto-Correlation Test for Susceptible	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto-Correlation Test for Exposed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto-Correlation Test for Infected	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Auto-Correlation Test for Recovered	1	1	1	1	1	0	1	1	1	1	1	1	1	0	1
JEL	N80	N81	N82	N83	N84	N85	N86	N87	N90	N91	N92	N93	N94	N95	N96
Durbin-Watson for Susceptible	0.82197	0.71181	0.97468	0.9692	0.95957	0.8157	1.0569	0.96389	0.82448	0.79508	0.77671	1.06135	0.82387	0.81897	0.82468
Durbin-Watson for Exposed	0.58668	0.63748	1.20927	1.10011	1.06982	0.60568	1.23193	1.01233	0.61911	0.63524	0.60518	1.26817	0.60267	0.56168	0.62299
Durbin-Watson for Infected	2.16816	1.77758	2.18866	2.51978	2.86655	1.69666	2.10158	2.35503	1.72392	1.80589	1.76788	1.61652	0.98775	2.17753	1.51607
Durbin-Watson for Recovered	3.14953	2.36136	2.64688	2.76333	3.29699	2.52987	3.07873	3.20093	3.07166	2.69126	2.8208	2.5524	2.54115	3.2009	2.43552
Auto-Correlation Test for Susceptible	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto-Correlation Test for Exposed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto-Correlation Test for Infected	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Auto-Correlation Test for Recovered	1	1	1	1	1	0	1	1	0	1	1	0	0	1	0

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JEL	N97	O10	O11	O12	O13	O14	O15	O16	O17	O18	O19	O20	O21	O22	O23
Durbin-Watson for Susceptible	0.81564	1.04846	1.05722	0.8062	1.05134	1.055	0.96249	1.00729	1.05461	1.06017	0.72406	1.04223	0.80595	0.8125	0.8193
Durbin-Watson for Exposed	0.62325	1.12159	1.09482	0.73026	1.12417	1.07312	0.98858	0.91847	1.07551	1.09168	0.69266	1.14183	0.73811	0.70712	0.7551
Durbin-Watson for Infected	1.78899	1.76979	0.83435	1.23691	0.74669	1.10445	1.28013	1.54185	1.22377	0.8886	0.77749	2.435	1.24527	1.72641	0.55256
Durbin-Watson for Recovered	2.26612	2.15222	1.53002	2.34792	1.30338	2.19864	2.14202	1.57588	2.59048	3.07963	2.27229	2.98608	1.90091	3.13356	1.64358
Auto-Correlation Test for Susceptible	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto-Correlation Test for Exposed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto-Correlation Test for Infected	1	1	0	1	0	1	1	0	1	1	1	1	1	1	0
Auto-Correlation Test for Recovered	1	1	0	0	0	0	0	0	0	0	0	1	0	0	0
JEL	O24	O25	O29	O30	O31	O32	O33	O34	O38	O39	O40	O41	O42	O43	O47
Durbin-Watson for Susceptible	0.82807	0.81019	1.05878	0.82224	0.83344	0.99576	0.82818	1.05073	0.75982	0.83464	0.80858	0.78619	1.05385	0.8201	0.83184
Durbin-Watson for Exposed	0.76638	0.84562	1.07643	0.79055	0.73764	1.08082	0.75199	1.08435	0.67449	0.75263	0.80116	0.81045	1.04771	0.80176	0.78291
Durbin-Watson for Infected	0.66978	0.87375	1.99899	0.40186	1.05274	2.04414	0.72788	1.00484	1.64092	1.99694	1.68049	1.36755	1.95305	1.05619	0.48494
Durbin-Watson for Recovered	2.19999	1.30795	3.00123	1.30802	1.83312	3.07523	2.34412	2.92814	2.80435	2.94627	2.24035	2.67863	2.21981	1.57319	1.68734
Auto-Correlation Test for Susceptible	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto-Correlation Test for Exposed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto-Correlation Test for Infected	1	0	1	0	1	1	1	1	1	1	1	1	1	0	0
Auto-Correlation Test for Recovered	0	0	1	0	0	1	0	0	0	1	0	0	1	0	0
JEL	O49	O50	O51	O52	O53	O54	O55	O56	O57	P00	P10	P11	P12	P13	P14
Durbin-Watson for Susceptible	0.8342	0.83797	0.83138	1.05509	0.82566	1.05732	0.83277	0.82503	1.04972	1.04783	0.99833	1.03859	0.79653	0.78918	1.00569
Durbin-Watson for Exposed	0.75092	0.73921	0.78003	1.1006	0.80367	1.07533	0.76678	0.79497	1.10079	1.40545	1.28245	1.44325	1.27522	1.18477	1.21946
Durbin-Watson for Infected	1.93942	1.85882	2.16402	2.45634	2.34149	3.11205	2.24721	2.61995	2.4329	1.9229	2.15851	1.19378	2.22926	1.25561	2.15659
Durbin-Watson for Recovered	2.79888	2.65555	2.94823	2.5306	2.65876	2.84609	2.98438	2.7702	3.03188	2.7318	3.04154	2.30028	2.74551	2.81669	2.69863
Auto-Correlation Test for Susceptible	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto-Correlation Test for Exposed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto-Correlation Test for Infected	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Auto-Correlation Test for Recovered	1	1	1	1	1	1	1	1	1	1	1	0	1	0	1
JEL	P16	P17	P19	P20	P21	P22	P23	P24	P25	P26	P27	P28	P29	P30	P31
Durbin-Watson for Susceptible	1.02594	0.80666	1.0483	1.04631	0.8072	1.0459	1.00997	0.9966	0.80942	1.00575	0.80696	0.80494	1.04607	0.80726	0.78852
Durbin-Watson for Exposed	1.46677	1.21244	1.41451	1.38173	1.18431	1.35835	1.3201	1.29181	1.26923	1.32268	1.18382	1.20372	1.43975	1.2147	1.28706
Durbin-Watson for Infected	1.44778	1.74792	1.74498	2.00602	1.67427	2.86233	1.5544	1.61961	0.98725	1.12851	2.83324	0.69369	1.70931	1.96034	0.97553
Durbin-Watson for Recovered	1.99706	2.21799	2.83521	3.33887	2.01319	2.78048	3.24074	2.24265	3.31305	2.39429	2.83533	2.16334	2.47411	2.39791	2.27303
Auto-Correlation Test for Susceptible	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto-Correlation Test for Exposed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto-Correlation Test for Infected	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Auto-Correlation Test for Recovered	0	1	1	1	0	1	0	0	0	0	1	0	0	1	0

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JEL	P32	P33	P34	P35	P36	P37	P39	P40	P41	P42	P43	P44	P45	P46	P47
Durbin-Watson for Susceptible	0.98315	0.74672	1.01106	0.7848	1.04446	0.7984	1.04564	0.78612	0.80718	0.80582	1.03601	0.80085	0.80763	0.80572	1.03561
Durbin-Watson for Exposed	1.31728	1.20488	1.34228	1.26595	1.32765	1.18271	1.29097	1.16195	1.22483	1.23953	1.4527	1.22029	1.25292	1.25167	1.47099
Durbin-Watson for Infected	1.8979	1.16522	1.30508	2.03081	1.7444	1.35872	1.80715	1.36373	2.30859	1.725	0.49564	1.60457	1.35891	1.81688	1.84295
Durbin-Watson for Recovered	2.39241	3.04746	1.86329	2.26048	3.09116	1.69686	3.28111	2.67349	3.05259	2.30713	2.49707	2.49422	2.02921	2.27522	2.70591
Auto-Correlation Test for Susceptible	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto-Correlation Test for Exposed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto-Correlation Test for Infected	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1
Auto-Correlation Test for Recovered	1	0	0	1	1	0	1	0	1	0	0	0	0	1	1
JEL	P48	P49	P50	P51	P52	P59	Q00	Q01	Q10	Q11	Q12	Q13	Q14	Q15	Q16
Durbin-Watson for Susceptible	0.80434	0.80492	1.04872	0.80719	0.80731	0.80621	0.79128	1.0485	1.06215	1.02831	0.96117	0.82176	1.06461	0.80533	1.04463
Durbin-Watson for Exposed	1.2411	1.21128	1.42008	1.18895	1.17084	1.25124	0.70277	0.93803	0.99077	0.94869	0.89181	0.83197	1.00448	0.83028	0.99287
Durbin-Watson for Infected	2.1688	1.61919	1.70992	2.3648	2.20483	1.97545	1.75005	1.04972	1.02006	1.28464	0.71856	0.76702	0.83493	0.73079	1.41756
Durbin-Watson for Recovered	3.30198	2.63737	2.36541	2.76234	2.6326	2.99253	2.42242	2.21149	1.76143	1.8579	1.3719	1.74536	2.60081	2.39214	3.36029
Auto-Correlation Test for Susceptible	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto-Correlation Test for Exposed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto-Correlation Test for Infected	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1
Auto-Correlation Test for Recovered	1	0	0	1	1	1	1	0	0	0	0	0	0	0	0
JEL	Q17	Q18	Q19	Q20	Q21	Q22	Q23	Q24	Q25	Q26	Q27	Q28	Q29	Q30	Q31
Durbin-Watson for Susceptible	0.77891	1.0389	0.81371	1.03573	0.75425	1.01699	0.97453	0.77464	0.97489	0.67709	1.02257	0.98821	0.81105	0.8107	0.78951
Durbin-Watson for Exposed	0.74792	1.01545	0.8511	0.89411	0.64993	0.92401	0.88142	0.78166	0.81479	0.62878	0.87958	0.79959	0.78111	0.81552	0.74997
Durbin-Watson for Infected	2.13438	1.48538	1.97996	2.28062	1.62294	1.52492	1.0277	0.902	2.07194	1.50968	1.76227	1.79801	1.91746	1.27461	2.33694
Durbin-Watson for Recovered	3.36854	3.14425	2.52309	2.27272	1.59418	1.79872	1.698	2.08313	1.8347	1.82273	2.46555	1.91574	2.81702	2.92878	2.60902
Auto-Correlation Test for Susceptible	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto-Correlation Test for Exposed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto-Correlation Test for Infected	1	1	1	1	0	1	0	1	1	1	1	1	1	1	1
Auto-Correlation Test for Recovered	1	0	1	1	0	0	0	0	1	0	1	1	1	0	1
JEL	Q32	Q33	Q34	Q38	Q40	Q41	Q42	Q43	Q47	Q48	Q49	Q50	Q51	Q52	Q53
Durbin-Watson for Susceptible	1.05367	1.0491	0.81288	0.99418	0.82671	1.06738	1.07418	0.82527	0.98629	0.82276	1.04812	0.83287	0.79909	0.79829	1.05116
Durbin-Watson for Exposed	0.94035	0.93182	0.68716	0.86534	0.77126	0.95103	0.91179	0.77185	1.0525	0.79168	0.9915	0.70522	0.67667	0.66208	0.84329
Durbin-Watson for Infected	0.98238	1.44992	1.67291	2.34663	0.9124	0.84982	0.51918	0.88532	2.20656	0.65672	1.94488	0.77453	1.2932	0.77213	0.87964
Durbin-Watson for Recovered	3.05235	2.2126	3.064	3.33084	3.18425	2.08998	2.20845	2.31368	2.9786	1.94972	2.9872	1.44556	2.83151	1.72728	2.10228
Auto-Correlation Test for Susceptible	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto-Correlation Test for Exposed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto-Correlation Test for Infected	1	1	1	1	1	1	1	1	1	1	1	0	1	0	1
Auto-Correlation Test for Recovered	0	0	0	1	0	0	0	0	1	0	1	0	0	0	0

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JEL	Q54	Q55	Q56	Q57	Q58	Q59	R00	R10	R11	R12	R13	R14	R15	R19	R20
Durbin-Watson for Susceptible	1.08299	0.79665	0.79705	1.07316	0.80682	1.06075	0.80856	1.04582	0.77753	1.0042	1.03946	0.80489	1.00668	1.0417	0.80863
Durbin-Watson for Exposed	0.87846	0.65138	0.69527	0.83915	0.66998	1.0144	0.94246	1.14599	0.89284	1.12392	1.10673	1.01762	1.10328	1.12424	0.9335
Durbin-Watson for Infected	0.7544	0.71339	1.01971	1.31479	0.68947	1.40689	1.94081	2.28413	1.26443	1.88502	1.88441	1.58307	2.0786	1.89348	2.38979
Durbin-Watson for Recovered	1.51768	2.63873	2.54346	2.63686	2.03996	1.91533	2.65696	2.83574	2.18974	2.85219	2.29708	1.66013	3.20207	2.95519	3.13269
Auto-Correlation Test for Susceptible	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto-Correlation Test for Exposed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto-Correlation Test for Infected	0	1	1	1	1	1	1	1	1	1	1	0	1	1	1
Auto-Correlation Test for Recovered	0	0	0	0	0	0	1	1	0	1	1	0	1	1	1
JEL	R21	R22	R23	R28	R29	R30	R31	R32	R33	R34	R38	R39	R40	R41	R42
Durbin-Watson for Susceptible	0.78741	0.80889	0.77857	0.81994	0.8089	0.79754	0.80215	0.79031	0.80196	1.0468	1.02267	1.04624	1.04305	0.81553	0.81515
Durbin-Watson for Exposed	0.96613	0.94756	0.88704	0.8388	0.93677	0.97457	0.93486	0.95237	0.90199	1.14426	1.09121	1.12607	1.17857	0.98305	0.89835
Durbin-Watson for Infected	0.57999	1.65856	1.00246	1.76207	1.97657	0.71954	1.14428	0.86343	1.81688	2.22235	2.4516	1.94654	0.70357	0.74621	0.69803
Durbin-Watson for Recovered	1.88197	2.48269	1.56905	2.98535	2.95496	1.01545	0.99161	2.85102	1.77663	2.5777	3.1008	3.17746	1.87348	2.1258	2.04588
Auto-Correlation Test for Susceptible	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto-Correlation Test for Exposed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Auto-Correlation Test for Infected	1	1	0	1	1	0	0	1	1	1	1	1	1	1	1
Auto-Correlation Test for Recovered	0	0	0	1	1	0	0	0	1	1	1	1	0	0	0
JEL	R48	R49	R50	R51	R52	R53	R58	R59	Z00	Z10	Z11	Z12	Z13	Z19	
Durbin-Watson for Susceptible	1.05638	0.80968	1.03271	1.05405	1.04035	0.79106	1.01535	0.80584	0.76414	0.92165	0.79016	0.55746	0.62202	0.98881	
Durbin-Watson for Exposed	1.19707	0.93319	1.1203	1.16573	1.13606	0.87542	1.0703	0.92183	1.5908	1.42998	1.63019	0.93134	0.81578	1.64423	
Durbin-Watson for Infected	0.76117	2.01995	1.96397	1.59871	0.91093	0.71121	1.30887	1.88229	1.93814	3.22311	1.09657	0.73115	1.01978	1.93947	
Durbin-Watson for Recovered	2.50749	2.88904	3.27653	3.0375	2.6978	2.55869	1.75556	2.86797	3.00903	1.91032	1.61667	2.01232	0.98771	2.96979	
Auto-Correlation Test for Susceptible	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Auto-Correlation Test for Exposed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Auto-Correlation Test for Infected	1	1	1	1	1	1	1	1	1	1	0	1	0	1	
Auto-Correlation Test for Recovered	0	1	1	0	0	0	0	1	1	1	0	0	0	1	

APPENDIX C

R-SQUARED VALUES

	A10	A11	A12	A13	A14	A19	A20	A21	A22	A23	A29	B00	B10	B11	B12	B13	B14
dS R-sq	0.05	0.0602	0.0538	0.0516	0.058	0.0582	0.0469	0.0568	0.0589	0.0521	0.0551	0.0595	-0.0352	0.0555	0.0399	0.0077	0.039
dE R-sq	0.1916	-0.0775	-0.0413	0.0379	-0.057	0.1653	-0.0201	0.0182	-0.0576	-0.0204	-0.0419	-0.0119	0.0608	-0.0343	-0.0119	-0.017	-0.0093
dI R-sq	0.2566	0.3191	0.2502	0.167	0.157	0.5529	0.416	0.2585	0.163	0.4688	0.5841	0.5437	0.4251	0.6443	0.4223	0.5625	0.3377
dR R-sq	0.0016	0.1269	0.0137	0.007	0.1384	-0.0013	-0.002	0.0154	0.1156	0.0213	-0.1387	0.0115	0.0046	0.0068	0.0753	0.1042	0.028
	B14	B15	B16	B19	B20	B21	B22	B23	B24	B25	B29	B30	B31	B32	B40	B41	B49
dS R-sq	0.039	0.0506	0.0585	0.0198	-0.5177	-0.0251	-0.0039	0.0587	-0.0314	0.0307	-0.085	0.0588	-0.0045	0.058	0.0275	-0.0053	0.0571
dE R-sq	-0.0093	-0.0092	0.1578	0.0573	-0.4023	0.007	-0.0222	-0.0042	0.0731	-0.0146	0.1282	0.0338	0.0174	0.0997	-0.0415	-0.0363	-0.0056
dI R-sq	0.3377	0.356	0.0611	0.3146	0.2669	0.2571	0.3899	0.5284	0.3166	0.3259	0.2854	0.3673	0.1176	0.5823	0.2184	0.3006	0.5066
dR R-sq	0.028	0.0989	0.4076	0.0006	0.0009	-0.0029	0.0193	0.0223	0.0043	0.0254	0.0071	0.1791	0.082	0	0.0042	0.0793	-0.0359
	B49	B50	B51	B52	B53	B54	B59	C00	C01	C02	C10	C11	C12	C13	C14	C15	C16
dS R-sq	0.0571	0.0511	0.0512	0.0447	0.0617	0.0385	0.051	-0.1437	0.0694	0.0625	-0.1239	0.026	0.0416	0.058	-0.0179	-0.0262	-0.2416
dE R-sq	-0.0056	0.0906	0.0399	0.0685	0.017	0.1109	-0.0108	-0.0468	-0.6217	0.1718	0.0218	0.2378	0.2561	0.2114	0.0801	0.0877	-0.0396
dI R-sq	0.5066	0.2711	0.1593	0.1539	0.1661	0.1396	0.5453	0.4283	0.5652	0.0653	0.222	0.3626	0.5553	0.3532	0.5695	0.3798	0.1516
dR R-sq	-0.0359	-0.0008	0.2683	0.1836	0.0629	0.158	-0.001	0.007	0.1354	0.4687	0.1751	-0.0065	-0.0051	0.0163	-0.0047	0.0049	0.195
	C16	C18	C19	C20	C21	C22	C23	C24	C25	C26	C29	C30	C31	C32	C33	C34	C35
dS R-sq	-0.2416	-0.0382	-0.1731	0.0016	0.0573	0.0325	0.0554	0.0222	0.0515	0.0279	-0.1219	0.0495	-0.0118	0.0446	0.0087	-0.1044	0.0556
dE R-sq	-0.0396	0.0228	-0.0447	0.1589	0.1471	0.2126	0.132	0.1519	0.2533	-0.4594	-0.0169	0.2203	0.0341	0.2246	0.1807	0.0289	0.1619
dI R-sq	0.1516	0.5267	0.5384	0.3041	-0.7024	0.6098	-1.1019	0.3735	0.0615	0.9894	0.5137	0.2	0.46	0.593	0.4079	0.6272	-0.2045
dR R-sq	0.195	0.018	-0.068	0.0255	0.0994	0.1566	0.0938	0.0021	0.1371	0.0597	-0.0023	0.0165	0.0127	0.1163	-0.0157	0.0271	0.1771
	C35	C40	C41	C43	C44	C45	C46	C49	C50	C51	C52	C53	C58	C59	C60	C61	C62
dS R-sq	0.0556	-0.0851	-0.0167	0.0541	0.0523	0.0549	0.014	-0.1722	-0.0167	0.0513	0.005	0.0571	-0.0039	-0.1825	-0.0727	-0.0323	0.051
dE R-sq	0.1619	0.05	0.1257	0.2586	-0.2154	0.2475	-0.731	-0.074	0.2258	0.3394	0.1442	0.2611	-0.2427	-0.0441	0.0931	-0.016	0.089
dI R-sq	-0.2045	0.5451	0.4066	0.2382	-0.4849	0.282	-0.0802	0.5144	0.2023	-0.0454	0.2857	-1.2964	0.9762	0.6072	0.3494	-1.7598	-0.71
dR R-sq	0.1771	0.1611	-0.008	0.1728	0.0996	0.0447	-0.1339	0.0026	0.001	0.373	0.0592	0.4168	0.9202	-0.0023	-0.0054	0.3817	0.5888
	C62	C63	C65	C67	C68	C69	C70	C71	C72	C73	C78	C79	C80	C81	C82	C83	C87
dS R-sq	0.051	0.0666	0.0415	0.0497	-0.1162	-0.0985	0.0541	0.0409	0.0479	0.0318	0.053	-0.1302	-0.0817	0.0518	-0.0009	0.0586	-0.1593
dE R-sq	0.089	0.0223	0.3153	0.4704	-0.0258	0.0766	0.2671	0.2498	0.236	0.1945	0.2404	0.0471	0.0204	0.2567	0.1535	0.1233	-0.0459
dI R-sq	-0.71	-1.1602	0.2743	0.4576	0.4945	0.2795	0.5308	-0.0596	0.0465	0.2004	-0.0489	0.5011	0.5547	0.3727	0.4169	-0.6959	0.1979
dR R-sq	0.5888	0.4814	0.16	0.0352	-0.024	0.0015	0.0951	0.2766	0.3038	0.1703	0.2226	0	0.0051	0.0742	-0.0051	0.2391	-0.0156
	C87	C88	C90	C91	C92	C93	C99	D00	D01	D02	D03	D10	D11	D12	D13	D14	D18
dS R-sq	-0.1593	-0.123	0.0587	0.0525	0.0552	0.0182	-0.1218	-0.0962	-0.0286	0.052	-0.0764	-0.0415	0.0399	0.055	-0.0281	0.0472	0.0491
dE R-sq	-0.0459	0.0066	0.0935	0.1067	0.1837	-0.3871	0.001	-0.039	0.0373	-0.0583	0.0144	0.0713	0.1798	0.1645	0.0625	0.019	0.2045
dI R-sq	0.1979	0.1462	-0.0562	-0.6178	0.1273	-0.891	0.5019	0.1838	-0.0396	-0.0497	0.9664	0.7022	0.4169	-0.2081	0.0922	-0.1332	0.7244
dR R-sq	-0.0156	0.0505	0.0948	0.4658	0.0877	0.0848	0	0.0091	0.3668	0.2726	0.9177	-0.0749	0.1179	0.5257	0.1533	0.7243	0.1309

R-SQUARED VALUES

	D18	D19	D20	D21	D22	D23	D24	D30	D31	D33	D39	D40	D41	D42	D44	D45	D46
dS R-sq	0.0491	-0.0711	-0.0848	0.0472	-0.0448	0.0419	0.0549	-0.0916	0.0509	-0.0895	0.0188	-0.0389	0.0523	0.0433	0.0312	-0.0437	-0.103
dE R-sq	0.2045	0.0508	-0.0037	0.143	-0.0993	0.0829	0.1175	-0.0148	0.1514	0.0054	0.2149	0.0272	0.1628	0.1498	0.1246	0.043	-0.0292
dI R-sq	0.7244	0.2841	0.2747	0.3823	0.9955	-0.4448	-0.1827	0.2657	0.3424	0.4271	0.5083	0.3435	0.1429	0.3103	0.1054	0.2535	0.2585
dR R-sq	0.1309	0.0202	0.0109	0.1337	0.4176	0.5904	0.7812	0.0337	0.3617	0.0095	0.0056	0.0245	0.3655	0.2416	0.2251	0.054	0.0088
	D46	D49	D50	D51	D52	D53	D57	D58	D59	D60	D61	D62	D63	D64	D69	D70	D72
dS R-sq	-0.103	-0.0701	-0.0283	-0.0775	-0.101	0.0096	-0.0064	-0.0696	-0.0754	-0.0226	0.0481	-0.0052	0.0308	0.0258	-0.0874	-0.1004	0.045
dE R-sq	-0.0292	0.0612	0.0966	0.0075	-0.0168	-0.0094	0.1412	0.0262	0.0477	0.0728	0.1875	0.125	0.1342	0.1093	0.0306	-0.0339	0.1815
dI R-sq	0.2585	0.5258	0.3592	0.2329	0.3203	-0.0239	0.4291	0.3088	0.2495	0.4047	0.4847	0.5191	0.4529	0.0513	0.4026	0.3356	-0.2018
dR R-sq	0.0088	-0.0005	-0.0002	0.0128	0.0033	0.467	0.0426	-0.0284	0.0905	-0.0164	0.1417	0.0025	0.176	0.2526	-0.0003	-0.0059	0.48
	D72	D73	D74	D78	D79	D80	D81	D82	D83	D84	D85	D86	D87	D90	D91	D92	D99
dS R-sq	0.045	0.0539	0.0478	-0.0729	-0.0715	-0.1921	0.0594	0.0582	0.0116	0.025	0.0351	0.0687	0.0229	-0.0794	-0.0704	-0.0018	-0.0908
dE R-sq	0.1815	0.1537	0.1327	0.0094	0.0068	-0.1228	0.1224	0.1286	0.0548	0.128	-0.0911	-0.1204	-0.1465	0.0123	0.0119	-0.0075	-0.0113
dI R-sq	-0.2018	0.0891	0.0119	0.0399	0.5574	0.3085	-0.746	-0.313	-0.5406	0.4888	0.1824	0.3049	0.5312	0.2198	0.4054	0.7785	0.5307
dR R-sq	0.48	0.4379	0.3328	0.1905	0.2221	0.0182	0.3314	0.6175	0.2728	0.0504	0.3752	0.8173	0.2992	0.0294	0.1273	0.2885	-0.0001
	D99	E00	E01	E02	E10	E11	E12	E13	E17	E19	E20	E21	E22	E23	E24	E25	E26
dS R-sq	-0.0908	0.0063	-0.0533	0.0659	0.0292	0.0253	0.0506	0.0642	0.042	0.0148	0.0524	0.0589	0.0548	0.0751	0.0547	0.0527	0.0168
dE R-sq	-0.0113	-0.01	-0.0284	-0.0442	0.0633	0.0574	0.0425	-0.0133	0.062	0.0408	0.0833	0.0624	0.0584	0.0662	0.0794	0.0601	0.0048
dI R-sq	0.5307	0.3415	0.0904	0.2622	0.2347	0.2152	0.1017	-0.1073	0.3873	0.2447	0.3899	0.222	0.4437	-0.1874	0.1662	0.2459	0.0377
dR R-sq	-0.0001	-0.0016	0.1643	0.1512	-0.0199	-0.0018	0.273	0.2228	0.0188	0.0662	-0.0003	0.3897	0.3873	0.5318	0.347	0.2219	0.2916
	E27	E30	E31	E32	E37	E40	E42	E43	E44	E47	E50	E51	E52	E58	E60	E61	E62
dS R-sq	0.0611	0.0227	0.0564	0.06	0.0639	0.0169	0.04	0.0566	0.0668	0.0617	0.0206	0.0397	0.0376	0.058	0.0109	0.0283	0.0464
dE R-sq	-0.0206	0.0365	0.0262	0.0626	0.0197	0.0925	0.0426	0.0458	0.0616	-0.0151	0.0341	0.0747	0.0397	0.0609	0.004	0.0324	0.0588
dI R-sq	-0.279	0.1727	0.4935	-0.1494	0.1833	0.4177	0.452	0.3508	-0.5574	0.219	0.1085	0.5478	0.0951	0.1488	0.3763	0.3736	0.4913
dR R-sq	0.2304	0.01	0.5229	0.3862	0.1044	0.0337	0.1416	0.4762	0.209	0.0781	-0.025	0.056	0.5221	0.3668	0.0019	0.0018	0.4098
	E63	E64	E65	E66	F00	F01	F02	F10	F11	F12	F13	F14	F15	F16	F17	F18	F19
dS R-sq	0.0233	0.0196	0.0366	-0.0332	0.0583	0.0564	-0.0119	0.065	-0.1709	-0.1126	-0.0643	0.0521	0.062	0.047	0.0641	0.0627	0.0589
dE R-sq	0.0253	0.0339	0.0401	-0.1129	0.0567	0.0625	0.1129	0.0202	-0.0118	-0.0284	-0.0054	-0.0582	-0.0155	0.0491	0.0179	0.0005	0.0235
dI R-sq	0.3001	0.2574	0.4648	0.3659	0.1894	0.3874	-0.0461	0.3462	0.3832	0.4981	0.3208	0.3176	0.3554	0.3139	0.2654	0.2055	0.3195
dR R-sq	0.0142	0.0002	0.0113	0.0063	0.0056	0.0038	0.116	0.0418	0.0665	0.0899	0.3664	0.5537	0.4359	0.0439	0.0017	0.0888	0.0418
	F20	F21	F22	F23	F24	F29	F30	F31	F32	F33	F34	F35	F36	F37	F39	F40	F41
dS R-sq	0.0551	0.0355	0.0247	0.036	0.0465	0.0966	0.0542	0.0049	0.0323	0.0624	-0.0092	0.0433	-0.0829	0.0215	0.0935	0.0377	-0.1047
dE R-sq	0.1472	0.0011	0.0133	-0.0446	0.0903	-0.3535	0.0682	-0.0397	0.0231	0.0004	0.015	-0.0286	-0.0158	0.0273	-0.3327	-0.0074	0.0451
dI R-sq	0.1988	0.7043	0.6408	0.1116	0.2139	0	0.4104	0.4756	0.2918	0.2094	0.2134	0.2869	0.0488	-0.1071	0.8119	0.363	0.4482
dR R-sq	0.0029	0.1019	0.1116	0.4049	0.4523	0	0.0109	0.6267	0.2027	0.3255	0.0647	0.1199	0.1609	0.0585	-0.0078	0.2247	0.0465

R-SQUARED VALUES

	F42	F43	F47	F50	F51	F52	F53	F54	F55	F59	G00	G01	G10	G11	G12	G13	G14
dS R-sq	0.0074	-0.0069	0.0632	-0.0088	-0.0264	0.0161	-0.0313	-0.0612	0.0314	0.0582	-0.0559	-0.0108	-0.0166	0.056	0.0451	0.0407	0.0452
dE R-sq	0.018	-0.011	0.0237	0.0479	0.1071	0.1226	0.1053	0.0974	0.0563	-0.0039	-0.0168	-0.0066	0.0386	0.0927	0.1196	0.1146	0.1109
dI R-sq	0.4167	0.1779	0.3174	0.0737	0.266	0.1136	0.1851	0.2087	0.1564	0.5545	0.1879	0.5573	0.6617	-0.1546	0.0143	0.2113	0.5731
dR R-sq	0.0587	0.1042	0.1212	0.3472	0.4744	0.3647	0.1768	0.3298	0.2347	-0.0001	0.0336	0.6026	0.1563	0.5722	0.2809	0.2822	0.4399
	G15	G17	G18	G19	G20	G21	G22	G23	G24	G28	G29	G30	G31	G32	G33	G34	G35
dS R-sq	0.0443	0.0372	0.0478	-0.0572	0.0459	0.0503	0.05	0.0412	0.06	0.0304	-0.0582	-0.1063	0.0491	0.062	0.0275	0.0497	0.0587
dE R-sq	0.099	-0.1468	0.1116	-0.0101	0.1709	0.1286	0.1275	0.0789	0.0582	0.0622	-0.022	-0.1143	0.0884	0.107	0.1027	0.1107	0.0693
dI R-sq	0.0153	0.1073	0.1444	0.2781	0.4055	0.1762	0.3234	-0.0913	0.0276	-0.3877	0.3065	0.4864	-0.663	-0.2607	0.2914	-0.0258	-0.1346
dR R-sq	0.2065	0.7422	0.324	0.0003	0.1043	0.4864	0.3959	0.4913	0.3753	0.4316	0.0369	-0.0716	0.5275	0.6108	0.1136	0.6492	0.264
	G38	G39	H00	H10	H11	H12	H20	H21	H22	H23	H24	H25	H26	H27	H29	H30	H31
dS R-sq	-0.0152	-0.0569	0.0149	0.0066	0.0596	0.0491	0.0601	0.0507	0.0489	0.0549	0.0542	0.0587	0.0598	0.0198	0.0186	0.0166	0.056
dE R-sq	0.0295	-0.0042	0.0282	0.0124	0.0527	-0.3111	0.065	0.0936	0.0755	0.0568	0.0696	0.0445	0.0622	0.0145	0.0575	0.0417	0.1244
dI R-sq	0.1439	0.4438	0.2998	0.3026	0.0826	0.9871	0.1911	0.4721	0.3182	0.2348	0.4733	-0.0015	0.2784	0.3124	0.5589	0.1686	0.3582
dR R-sq	0.0618	0.008	0.0178	-0.0158	0.471	-0.0078	0.2135	0.0447	0.027	0.1849	0.3895	0.4667	0.1454	0.0045	0.007	0.0039	0.057
	H32	H39	H40	H41	H42	H43	H44	H50	H51	H52	H53	H54	H55	H56	H57	H59	H60
dS R-sq	0.0614	0.0069	0.0155	0.0533	0.0372	0.0552	0.0327	0.0546	0.0398	0.0624	0.0356	0.0589	0.0527	0.0416	0.0578	0.0072	0.0077
dE R-sq	0.0321	0.0094	0.0172	0.0599	0.0442	0.0946	-0.0087	0.0588	0.0499	-0.0293	0.0435	0.0543	0.091	0.0153	0.1107	0.0229	0.0005
dI R-sq	0.0836	0.413	0.4082	0.48	0.3513	0.3991	0.1322	0.294	-0.6823	-0.058	0.2477	0.2014	0.2815	0.0435	0.4145	0.6079	0.4365
dR R-sq	0.2424	0.0246	0.0533	0.1652	0.0092	0.0547	0.4228	0.1795	0.3612	0.2746	0.0018	0.2435	0.1812	0.3792	0.0295	-0.0102	-0.0039
	H61	H62	H63	H68	H70	H71	H72	H73	H74	H75	H76	H77	H79	H80	H81	H82	H83
dS R-sq	0.0474	0.044	0.0495	0.0039	0.0331	0.0585	0.0692	0.0503	0.0606	0.0142	0.0406	0.0582	0.0121	0.0012	0.0169	0.0243	-0.0069
dE R-sq	0.0428	0.0881	0.0345	-0.0041	0.0406	0.0552	0.4546	0.0785	0.0497	0.0325	-0.0027	0.0658	0.0025	-0.0085	0.0199	0.003	0.0155
dI R-sq	0.2343	0.4539	0.2465	0.3743	0.657	0.119	0.1262	0.6688	0.258	0.0213	-0.1346	0.4068	0.1789	0.5477	0.3517	0.1338	-0.0071
dR R-sq	0.0963	0.0884	0.1346	0.0864	0.0634	0.4158	0	0.1392	0.0614	0.8589	0.8474	0.1238	0.2988	-0.0002	0.0361	0.0611	0.3602
	H87	H89	I00	I10	I11	I12	I18	I19	I20	I21	I22	I23	I28	I29	I30	I31	I32
dS R-sq	0.0456	0.0124	0.0175	0.0532	0.0536	0.0581	0.0551	-0.0107	-0.0692	0.055	0.0288	0.0617	0.0591	0.0375	-0.1413	0.0518	0.0384
dE R-sq	0.0698	0.0455	0.031	0.0337	0.0829	0.0436	0.0408	-0.0832	0.0333	0.0347	0.1171	-0.0111	0.0258	0.0442	-0.0986	0.0311	0.0274
dI R-sq	0.209	0.55	0.3972	0.1962	0.1485	0.0654	0.1667	0.4952	-0.1435	0.3722	0.6104	0.2739	0.0117	0.3683	0.1223	-0.0189	0.2894
dR R-sq	0.083	-0.0003	0.0413	0.3443	0.3519	0.4927	0.4059	0.0774	0.2764	0.5102	0.076	0.5835	0.3826	0.0003	0.1172	0.5807	0.268
	I38	J00	J01	J08	J10	J11	J12	J13	J14	J15	J16	J17	J18	J19	J20	J21	J22
dS R-sq	0.0569	0.0531	0.0651	-0.056	0.056	0.0639	0.0654	0.0603	0.0594	0.0281	0.0536	0.0207	-0.0159	0.0737	0.0559	-0.0125	0.0527
dE R-sq	0.0584	0.1363	-0.0101	0.061	0.1359	0.0008	0.005	-0.0067	0.0065	0.0239	0.0169	0.1317	-0.1245	-0.0972	0.1085	0.1007	-0.0302
dI R-sq	0.1308	0.1941	0.3698	0.2073	0.163	0.2119	0.2084	0.2885	0.1907	0.0828	0.1088	0.3148	0.5938	0.6131	0.2432	0.2974	0.5033
dR R-sq	0.3894	0.0068	0.0711	0.296	0.0581	0.449	0.2035	0.3045	0.1816	0.1859	0.3465	0.021	0.0456	0.0469	-0.0034	0.0575	0.3179

R-SQUARED VALUES

	J23	J24	J26	J28	J29	J30	J31	J32	J33	J38	J39	J40	J41	J42	J43	J44	J45
dS R-sq	0.0617	0.0593	0.0626	0.0663	0.0578	0.0416	0.0495	0.028	0.0245	0.0245	0.0551	0.0525	-0.0404	-0.0175	0.0207	0.0649	0.0371
dE R-sq	0.0089	-0.0577	0.0023	-0.0043	-0.0189	0.2046	-0.0116	-0.0129	0.0171	0.0171	0.0128	0.1799	0.0145	-0.0281	0.0701	0.0042	-0.0582
dI R-sq	0.5323	0.5462	0.1974	0.2594	0.6143	0.242	0.412	0.2952	0.3471	0.3471	0.5447	0.2455	0.6119	0.2779	0.2921	-0.013	0.2108
dR R-sq	0.1666	0.3269	0.3608	0.1459	-0.0171	0.0092	0.5163	0.1778	0.0901	0.0901	0	0	0.2052	0.0273	0.0674	0.248	0.0904
	J48	J49	J50	J51	J52	J53	J54	J58	J59	J60	J61	J62	J63	J64	J65	J68	J69
dS R-sq	0.0556	0.0608	0.0074	-0.0116	0.0254	-0.0254	0.0443	0.0087	0.0565	0.0389	0.0606	0.0618	0.0619	-0.0392	0.009	-0.0565	0.069
dE R-sq	0.0053	0.046	0.138	0.0634	0.0158	0.0966	0.1394	0.2082	0.0057	0.1591	-0.0007	0.0291	0.0184	0.0149	-0.0223	0.0615	-0.0376
dI R-sq	0.6347	0.3066	0.3176	0.3515	0.3868	0.4931	0.1677	0.3014	0.5128	0.2598	0.3171	0.5477	0.7327	0.4655	0.5652	0.3635	0.5398
dR R-sq	-0.0006	0.1444	0.0299	0.1412	0.1476	0.0604	0.0221	0.0029	0	0	0.2277	0.0746	0.097	0.117	0.1433	0.0357	0.0078
	J70	J71	J78	J80	J81	J82	J83	J88	J89	K00	K10	K11	K12	K13	K14	K19	K21
dS R-sq	0.0557	0.0123	0.0123	0.0101	0.0354	-0.1709	-0.0726	0.0656	0.0555	-0.0249	0.0525	0.049	0.0467	-0.0532	0.0537	0.0066	0.0403
dE R-sq	0.0842	0.1034	0.1034	-0.0274	0.0227	-0.0036	0.0532	0.0242	0.0126	-0.0898	0.0232	-0.0227	0.0257	-0.2062	0.0351	-0.0267	0.0256
dI R-sq	0.311	0.1577	0.1577	0.1292	0.257	0.0822	0.1735	0.2659	0.5549	0.2099	0.4728	-0.0559	0.438	0.3629	0.2755	0.586	0.0959
dR R-sq	0.0304	0.0724	0.0724	0.1511	0.0196	0.1578	0.0975	0.0255	-0.0001	0.1834	0.1699	0.2347	0.0542	0.0478	0.0645	-0.0472	0.513
	K22	K23	K29	K30	K31	K32	K33	K34	K35	K36	K39	K40	K41	K42	K49	L00	L10
dS R-sq	0.0564	0.0496	0.0422	0.0345	0.0539	0.0579	0.0585	0.0157	0.0582	0.0554	0.0309	0.0179	0.0297	0.0563	-0.0208	-0.0233	-0.0239
dE R-sq	0.0203	0.023	0.0559	0.0601	0.0135	0.0559	0.0319	-0.0168	0.045	-0.0115	0.0245	0.0301	-0.0095	0.0343	0.2015	-0.0592	-0.0179
dI R-sq	0.3437	0.2321	0.4042	0.4698	0.1328	0.3327	0.0392	0.2074	0.4747	0.2312	0.5055	0.2361	0.4053	-0.0375	0.7496	0.2135	0.3722
dR R-sq	0.0864	0.0762	0.0307	-0.0379	0.2214	0.1314	0.1992	0.0994	0.0011	0.0319	-0.0176	0.1497	0.0218	0.4552	-0.0206	0.0212	0.0052
	L12	L13	L14	L15	L16	L17	L19	L20	L21	L22	L23	L24	L25	L26	L29	L30	L31
dS R-sq	0.0375	0.0472	0.0555	-0.0254	0.0428	0.0084	-0.0145	-0.0291	-0.4119	-0.0017	0.0224	0.0687	0.0397	0.0071	-0.0108	-0.0252	0.0621
dE R-sq	0.0932	0.1241	0.0259	-0.0286	0.1413	-0.0057	-0.006	-0.0136	-0.0406	0.0228	0.0449	0.0048	0.0505	0.0103	0.0264	-0.0384	0.0375
dI R-sq	0.6536	0.6461	-0.2117	0.4579	0.5757	-0.0084	0.5063	0.3088	-1.4456	0.3407	-0.1179	0.0131	-0.0951	0.0342	0.5543	0.2099	-0.1172
dR R-sq	0.3287	0.5444	0.8177	0.047	0.0309	0.1757	-0.0001	-0.0117	0.5617	0.0432	0.3749	0.4817	0.8904	0.5566	-0.0005	0.0014	0.2652
	L32	L33	L38	L40	L41	L42	L43	L44	L49	L50	L51	L52	L53	L59	L60	L61	L62
dS R-sq	0.0585	0.0416	-0.0138	0.0101	-0.063	-0.0477	-0.0314	-0.0362	-0.015	-0.0282	0.0508	0.0365	0.0671	-0.0119	0.0409	0.0549	0.04
dE R-sq	0.0559	0.1645	-0.0009	0.0992	-0.0954	-0.0288	-0.047	0.0041	-0.0149	-0.0231	0.1026	0.0663	-0.0104	-0.0152	0.082	0.0787	0.0539
dI R-sq	0.084	0.5796	0.5782	0.148	0.3056	0.3084	0.2324	0.4655	0.4029	0.2494	0.302	0.1619	0.1352	0.2908	0.6592	0.398	-0.0441
dR R-sq	0.1252	0.0424	-0.0007	0.2801	-0.0003	0.0057	0.0092	0.1693	0.0465	0.0059	0.3118	0.2863	0.0555	0.2493	0.2535	0.0616	0.2978
	L63	L64	L65	L66	L67	L68	L69	L70	L71	L72	L73	L74	L78	L79	L80	L81	L82
dS R-sq	-0.0426	0.0508	-0.0387	0.0462	0.0526	0.0092	-0.0658	-0.0249	0.034	-0.205	0.0142	0.0438	0.1191	-0.0141	0.0493	0.0397	0.0562
dE R-sq	0.0167	-0.0767	0.0462	0.0608	0.0885	0.1167	-0.0544	-0.0217	0.0465	-0.1624	0.0375	0.0572	-0.4475	-0.0082	0.1247	0.0097	0.0405
dI R-sq	0.1632	0.1141	0.3195	-0.077	0.4685	0.5946	0.547	0.5706	0.1262	0.1865	0.4696	0.6272	0.6215	0.5059	0.421	-0.0144	-0.0902
dR R-sq	0.1894	0.2072	0.1082	0.512	0.2656	0.0103	0.008	0.0085	0.2546	0.0615	0.0591	0.022	-0.0924	0	0.1268	0.5279	0.5097

R-SQUARED VALUES

	L83	L84	L85	L86	L87	L88	L89	L90	L91	L92	L93	L94	L95	L96	L97	L98	L99
dS R-sq	0.0335	0.0592	-0.0441	0.0461	-0.0216	0.064	-0.0006	-0.0412	-0.0406	0.0424	0.0485	0.0404	-0.044	0.0334	0.0436	0.0467	-0.0467
dE R-sq	0.0457	0.039	-0.042	0.1445	-0.0021	0.0306	0.0103	-0.0116	-0.0415	0.0334	0.0627	0.0629	-0.0307	0.0852	0.0602	0.0926	-0.0153
dI R-sq	-0.2833	0.0629	0.3122	0.2275	0.2555	0.1659	0.4844	0.3627	0.3956	-0.4027	0.0108	0.2141	0.2045	0.268	0.3692	0.3689	0.5407
dR R-sq	0.4833	0.1051	0.0595	0.0852	0.1222	0.0312	0.0136	0.0033	0.033	0.6456	0.5153	0.3363	0.1774	0.2524	0.0346	0.3456	-0.0067
	M00	M10	M11	M12	M13	M14	M15	M16	M19	M20	M21	M30	M31	M37	M38	M40	M41
dS R-sq	-0.1847	0.0594	0.0499	0.0581	0.0025	0.059	0.0137	0.01	-0.2212	-0.189	-0.2939	-0.1871	0.055	0.0586	-0.1373	-0.1861	0.0363
dE R-sq	-0.0109	0.0983	0.1362	0.2684	0.2038	0.1796	-0.071	0.0366	-0.0175	-0.019	-0.2027	0.0163	0.2545	0.2063	-0.0174	0.0304	0.2344
dI R-sq	0.2846	-0.3312	-0.8435	-1.4347	0.144	-0.2866	-0.5896	-0.0857	0.5758	0.2566	0.1825	0.694	-0.3811	-0.4623	0.8363	0.2466	0.4215
dR R-sq	0.0871	0.5352	0.4824	0.5712	0.2041	0.4193	0.9344	0.2494	0.0019	0.1107	0.0248	-0.0644	0.4264	0.3518	0.3908	0.1301	0.4582
	M42	M48	M49	M50	M51	M52	M53	M54	M55	M59	N00	N01	N10	N11	N12	N13	N14
dS R-sq	0.0534	0.0037	-0.2015	-0.0161	-0.0211	0.0411	0.0382	0.0618	-0.0651	-0.2253	0.0588	0.0454	0.0593	0.0517	0.022	-0.0046	-0.0042
dE R-sq	-0.0022	-0.1283	-0.0427	0.1353	0.1312	0.1493	0.1996	0.0554	0.0807	0.0401	0.0404	0.1314	0.0037	0.0503	0.003	0.0873	0.1152
dI R-sq	-0.2616	-0.1646	0.5467	0.0572	0.079	-0.1146	0.0175	-0.1014	0.1222	0.6454	0.3463	0.315	0.3261	0.2253	0.2976	0.3436	0.2327
dR R-sq	0.4538	0.7399	-0.0011	0.0628	0.0467	0.5452	0.3387	0.4829	0.0323	-0.0054	0.0054	-0.0011	0.1278	0.029	0.0481	0.0414	0.0381
	N15	N16	N17	N20	N21	N22	N23	N24	N25	N26	N27	N30	N31	N32	N33	N34	N35
dS R-sq	0.0585	0.0608	0.0374	0.0502	0.0411	0.026	0.0558	0.0491	0.0537	0.0584	0.0459	0.0608	-0.0009	-0.0508	0.0504	0.0555	0.0601
dE R-sq	0.0154	0.0178	0.0781	0.0029	0.0637	0.0795	0.019	0.036	0.0135	0.0024	0.0706	0.0053	0.0726	0.0132	-0.0209	-0.0106	-0.0001
dI R-sq	0.6093	0.4882	0.4021	0.3226	0.3683	0.4609	0.4286	0.4246	0.2353	0.258	0.4263	0.6454	0.2035	0.2717	0.443	0.3721	0.3206
dR R-sq	0.0618	0.013	-0.0004	0.1251	0.029	0.0299	0.1492	0.0406	0.0807	0.0181	0	0.018	0.0536	0.0569	0.092	0.1729	0.196
	N36	N37	N40	N41	N42	N43	N44	N45	N46	N47	N50	N51	N52	N53	N54	N55	N56
dS R-sq	0.0456	0.0281	0.0499	0.0609	0.059	0.057	0.0561	0.0608	0.0306	0.0596	0.0615	0.0503	0.0324	0.0438	0.0489	-0.0365	0.0545
dE R-sq	-0.0209	0.0239	0.0091	-0.0076	-0.0008	-0.0123	0.0127	0.0061	-0.0006	-0.0126	-0.0016	0.0438	-0.0004	0.0221	0.0053	-0.0279	0.0122
dI R-sq	0.4401	0.0828	0.1983	0.4053	0.2734	0.405	0.4625	0.367	0.1387	0.4888	0.5542	0.4245	0.5744	0.4309	0.3683	0.3548	0.5117
dR R-sq	0.1592	0.1859	0.0762	0.132	0.33	0.067	0.1402	0.0462	0.2219	0.1299	0.0137	0.0292	0.0121	0.0435	0.0155	0.0017	0.0008
	N57	N60	N61	N62	N63	N64	N65	N66	N67	N70	N71	N72	N73	N74	N75	N76	N77
dS R-sq	0.0611	0.0536	0.0441	-0.002	-0.0632	0.002	0.0514	0.0589	0.0552	0.0167	0.0082	0.0561	0.0602	0.059	0.0209	0.061	0.0028
dE R-sq	0.0119	-0.0112	0.1134	0.0572	0.0864	0.0222	0.0214	0.0229	0.0978	-0.0303	0.0287	-0.0052	-0.0187	-0.0012	-0.0214	0.0144	0.1299
dI R-sq	0.6298	0.4693	0.4855	0.3708	0.4355	0.504	0.3289	0.459	0.4013	0.4774	0.3868	0.424	0.6515	0.6407	0.378	0.3791	0.3047
dR R-sq	0.0002	0.0392	0.0003	0.003	0.0006	0.0264	0.0462	0.0266	-0.0291	-0.0202	0.0205	0.0426	0.0573	0.0399	0.0653	0.0353	0.0001
	N80	N81	N82	N83	N84	N85	N86	N87	N90	N91	N92	N93	N94	N95	N96	N97	O10
dS R-sq	0.0556	0.0076	0.036	0.0324	0.0272	0.06	0.0553	0.0288	0.0451	-0.0477	-0.087	0.0437	0.0528	0.0593	0.0325	0.0595	0.0553
dE R-sq	-0.0102	0.1358	0.0509	0.0169	0.0084	0.0167	0.0039	0.1096	0.0547	0.0933	0.0159	0.0162	0.0039	0.0017	-0.0345	0.0226	0.0374
dI R-sq	0.5366	0.1686	0.1168	0.3057	0.2736	0.3775	0.3725	0.4744	0.5915	0.1086	0.0692	0.12	0.1001	0.3973	0.2896	0.4365	0.4528
dR R-sq	-0.0014	0.0495	0.0835	0.05	0.0091	0.0516	0.0059	-0.0002	0.0042	0.0621	0.0654	0.167	0.0869	-0.0004	0.039	-0.015	0.0691

R-SQUARED VALUES

	O11	O12	O13	O14	O15	O16	O17	O18	O19	O20	O21	O22	O23	O24	O25	O30	O31
dS R-sq	0.0315	0.0654	0.0602	0.0593	0.0295	0.0563	0.0263	0.0509	0.0049	0.0537	0.0586	-0.0341	0.0643	0.0159	0.0005	0.004	0.004
dE R-sq	-0.0051	0.0243	0.0204	0.0251	0.0418	-0.0029	-0.0009	0.0108	0.0542	0.0679	0.0605	-0.0851	0.0377	-0.0142	0.0553	-0.0004	-0.0004
dI R-sq	0.0859	0.1429	0.1253	0.0794	0.0299	0.0359	0.0214	0.0239	0.1235	0.5538	0.3454	0.4752	0.1174	0.0139	0.1529	-0.0843	-0.0843
dR R-sq	0.5063	0.2727	0.69	0.4293	0.5063	0.3383	0.663	0.5955	0.347	0.0086	0.3473	0.0253	0.6323	0.3836	0.8529	0.4835	0.4835
	O32	O33	O34	O38	O39	O40	O41	O42	O43	O47	O49	O50	O51	O52	O53	O54	O55
dS R-sq	0.0413	0.0624	0.061	0.0338	0.0373	0.0537	0.045	0.0189	0.0024	0.0559	0.0397	0.0395	0.0396	0.0393	0.0428	0.0366	0.0411
dE R-sq	0.1015	0.031	0.0311	0.0463	0.0075	0.0985	0.1233	-0.0355	0.0579	0.0228	-0.0237	-0.0325	0.0501	0.0248	0.0774	0.0045	0.0227
dI R-sq	0.3108	0.1226	0.1115	0.4325	0.5525	0.3505	0.5548	0.6081	0.1596	0.2246	0.5019	0.2604	0.3315	0.1518	0.166	0.1488	0.1903
dR R-sq	0.0668	0.54	0.3175	0.105	-0.0014	0.0323	0.2429	-0.0177	0.3096	0.6663	0.2208	0.0952	-0.0001	0.0121	0.01	0.0022	-0.0011
	O56	O57	P00	P10	P11	P12	P13	P14	P16	P17	P19	P20	P21	P22	P23	P24	P25
dS R-sq	0.0437	0.0582	0.0312	-0.0706	0.0128	0.0592	0.0616	0.0534	0.0579	0.0342	0.0369	0.0264	0.0354	0.0266	0.0557	0.0509	0.0424
dE R-sq	0.1141	0.0379	-0.0005	-0.0278	-0.0042	0.054	0.0377	0.0402	0.0581	-0.0177	0.0028	-0.0244	-0.0338	-0.0399	0.0216	0.0122	0.0028
dI R-sq	0.1855	0.3903	0.3254	0.4006	0.1175	0.3352	0.1318	0.1796	0.1838	0.2239	0.6479	0.2786	0.1956	0.1576	0.0964	0.093	0.0677
dR R-sq	-0.011	0.0175	0.0424	0.0157	0.2627	0.0236	0.2446	0.02	0.1409	0.0886	0.0175	-0.0044	0.0391	0.0112	0.2883	0.3717	0.3882
	P26	P27	P28	P29	P30	P31	P32	P33	P34	P35	P36	P37	P39	P40	P41	P42	P43
dS R-sq	0.0546	0.0417	0.0613	0.0512	0.0342	0.0607	0.0446	0.0428	0.0573	0.0592	0.0591	0.0631	0.0568	-0.0287	0.0362	0.035	0.0064
dE R-sq	0.0197	-0.0117	-0.0282	0.0464	-0.011	0.0251	0.0297	0.0375	0.0051	0.0633	-0.0053	-0.0059	0.0688	-0.0865	-0.013	-0.0025	-0.0165
dI R-sq	0.1421	0.1398	0.224	0.4304	0.2417	0.1794	0.2035	0.167	0.0452	0.407	0.0949	0.0458	0.4291	0.4403	0.3308	0.5342	-0.0206
dR R-sq	0.3399	0.0019	0.7514	0.0702	0.0249	0.4023	0.1529	0.2323	0.3546	0.0661	0.2594	0.2085	0.003	0.0653	0.0062	0.0117	0.3888
	P44	P45	P46	P47	P48	P49	P50	P51	P52	P59	Q00	Q01	Q10	Q11	Q12	Q13	Q14
dS R-sq	0.0588	0.0424	0.0453	0.0532	0.0228	0.0562	0.0381	0.0289	0.0263	0.0395	-0.0639	0.0598	0.0262	-0.0405	0.022	0.0421	0.0404
dE R-sq	0.0356	0.01	0.0389	0.1486	0.0019	0.055	0.0094	-0.0482	-0.0529	-0.0222	-0.0701	0.0473	0.0356	-0.059	0.0374	0.0537	0.0597
dI R-sq	0.3936	0.335	0.2222	0.3915	0.2583	0.3918	0.302	0.1708	0.161	0.5007	0.1571	0.0285	0.1958	0.2121	0.0093	-0.2163	0.4922
dR R-sq	0.0753	0.1178	0.074	0.0042	0.0172	0.1255	0.16	0.0053	0.0029	0	0.0231	0.201	0.1346	0.2872	0.4747	0.4407	0.2355
	Q15	Q16	Q17	Q18	Q19	Q20	Q21	Q22	Q23	Q24	Q25	Q26	Q27	Q28	Q29	Q30	Q31
dS R-sq	0.0566	0.055	-0.076	0.0522	0.0143	-0.0314	-0.1385	-0.0592	0.0265	-0.0815	-0.1341	-0.3155	-0.0594	-0.1118	-0.008	0.0054	-0.0609
dE R-sq	0.066	0.0786	-0.1251	0.0805	0.0417	-0.0986	-0.2726	-0.0875	0.0781	-0.1231	-0.2423	-0.4742	-0.0859	-0.2338	-0.0305	0.0059	-0.079
dI R-sq	0.5109	0.2588	0.466	0.4635	0.6107	0.1186	0.1816	0.3097	0.1943	0.3777	0.2002	0.0434	0.2237	0.1624	0.3232	0.1978	0.3219
dR R-sq	0.4618	0.2851	0.177	0.3437	-0.0163	0.0634	0.0027	0.3452	0.3322	0.1778	0.0895	-0.0825	0.1079	0.0446	0.049	0.0903	-0.0147
	Q32	Q33	Q34	Q38	Q40	Q41	Q42	Q43	Q47	Q48	Q49	Q50	Q51	Q52	Q53	Q54	Q55
dS R-sq	-0.0609	0.0654	0.0674	-0.1146	0.0431	0.0585	0.0612	0.0499	-0.1234	0.0526	-0.0024	0.0527	0.0646	0.0735	0.072	0.0675	0.0665
dE R-sq	-0.079	-0.0084	0.0082	-0.0616	0.0369	0.0246	-0.0026	0.0111	0.2177	0.0441	-0.0176	0.0318	-0.0017	-0.1091	-0.0796	-0.0647	-0.0326
dI R-sq	0.3219	-0.0345	0.0479	0.3862	0.2785	-0.2328	-0.3252	-0.1766	0.9861	-0.0967	0.5056	0.1238	-0.0097	-0.0423	-0.0024	0.1155	-0.0431
dR R-sq	-0.0147	0.1722	0.0433	0.0006	0.2062	0.5528	0.5718	0.5269	0.9134	0.5082	-0.0001	0.4299	0.1591	0.4637	0.5538	0.7954	0.357

R-SQUARED VALUES

	Q56	Q57	Q58	Q59	R00	R10	R11	R12	R13	R14	R15	R19	R20	R21	R22	R23	R28
dS R-sq	0.0655	0.0721	0.0715	0.0235	0.0117	0.0086	0.0538	0.0487	-0.0056	0.054	0.0497	0.0028	0.0091	0.0582	0.0118	0.0553	0.0359
dE R-sq	-0.0194	-0.0644	-0.0508	0.0512	0.0001	-0.0073	0.0316	0.0623	-0.0286	0.0811	0.0869	-0.0409	0.0032	0.0603	0.0022	0.0209	0.0521
dI R-sq	-0.0426	0.0236	-0.0607	0.3719	0.2396	0.4371	0.3235	0.4128	0.1282	0.6806	0.4912	0.432	0.4116	0.1472	0.3801	0.0332	0.3433
dR R-sq	0.291	0.4493	0.6141	0.1297	0.04	-0.014	0.2962	0.1672	0.0117	0.0492	0.0492	0.0103	0.0021	0.2987	0.0229	0.4577	0.0663
	R29	R30	R31	R32	R33	R34	R38	R39	R40	R41	R42	R48	R49	R50	R51	R52	R53
dS R-sq	0.0095	-0.0178	-0.0073	0.0585	-0.0122	0.0092	-0.0357	0.0071	0.0071	0.0529	0.0608	0.0425	0.0096	0.0549	0.0493	0.0595	0.0621
dE R-sq	-0.0088	0.011	-0.025	0.0655	-0.0448	-0.0038	-0.0583	-0.0089	-0.0089	0.0788	-0.0191	0.0277	-0.0051	0.1058	0.033	0.0396	0.011
dI R-sq	0.3894	-0.1168	0.0461	0.13	0.2573	0.2355	0.3498	0.4385	0.4385	-0.5491	-0.4203	-0.1289	0.6614	0.6168	0.1721	0.0313	-0.1007
dR R-sq	0.035	0.4232	0.3222	0.3231	-0.0041	0.0054	0.0957	0.0223	0.0223	0.3994	0.5785	0.1889	0.053	0.0208	0.0829	0.3732	0.4693
	R58	R59	Z00	Z10	Z11	Z12	Z13	Z19									
dS R-sq	0.0551	0.0012	-0.0848	-0.2061	0.061	-0.1575	-0.0707	-0.0848									
dE R-sq	0.0334	-0.0449	-0.0094	-0.1561	0.131	-0.0626	-1.7131	-0.0188									
dI R-sq	-0.0295	0.491	0.4997	0.0895	-0.3883	-0.6424	-0.0277	0.5266									
dR R-sq	0.4584	-0.003	0	-0.1013	0.2193	0.4443	0.5624	-0.0004									

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