

## **Part I: The Good Times**

During the second year of my PhD in physics at the University of Notre Dame, my advisor László Barabási—a well-known physicist and network scientist—asked me to visit an economist he had just met for lunch at a restaurant. The economist was Ricardo Hausmann, a professor of practice at the Harvard Kennedy School. Ricardo, who at some point in his life had wanted to get a PhD in physics, had recently read Laszlo's book *Linked*, and was inspired by his prose and ideas. He had invited Laszlo for lunch to talk about his book and to ask him if he knew anyone that could help him make sense of big data.

When I started my PhD in 2004, I told Laszlo that I wanted to combine network science and economics. But Laszlo, who understood how hostile academic disciplines can be to outsiders, told me that if I wanted to walk that path, I had to find the support of a second advisor. This serendipitous connection was my chance to explore that opportunity.

After a brief exchange of emails with Ricardo, I headed to the Harvard Kennedy School. Our first meeting was on March 24, 2006, at 10 am. Without delay Ricardo started pitching me his idea. Countries, he said, were collections of private firms, or monkeys, that lived in a forest. But the problem was that the trees were not all equal. Some trees had plenty of fruit while others were not so productive. Moreover, the forest was patchy, with some parts being dense, full of trees with plenty of fruit, while other parts were more deserted, with trees far from each other. Of course, all countries wanted to have their monkeys—or firms—in the best parts of the forest, but that was really hard to achieve if your monkeys were stuck on trees that were far from the center.

Ricardo and Bailey Klinger—his PhD student—wanted to map the forest and were off to a great start. Using international trade data, Bailey had calculated a measured distance between each pair of trees, or products. But that's where they got stuck. They didn't know how to go from that to a map of the forest that they could use to visualize the position of the monkeys and see how they jumped. That was my job. After the short meeting, Bailey invited me to his office where I copied the

international trade data they had into an external hard drive. We agreed to meet again in a few weeks.

That spring I was working at the Dana Farber Cancer Institute, a research and cancer treatment center affiliated with Harvard Medical School. Back then, networks were a new and hot topic in biology, but were not yet a popular idea in economics. Without having planned for it, I was suddenly becoming a bridge between academic fields: a physicist doing a PhD in network science at a lab dedicated to mapping biological networks. I soon realized that the best way to represent “the forest” was not using a smooth landscape, like that of the rolling hills of western Massachusetts, but a network, like the ones we were using at Dana Farber to describe genetic interactions. The reason was profound. Unlike in a real forest, where the ground is two dimensional, and pairs of trees that are close to each other are close to the same other trees, in the space of products distances are relational. What makes a product like natural gas similar to drilling machines, for instance, is very different from what makes drilling machines similar to steel tubes and pipes. Two “trees” that are close to each other could be at very different distances from a third tree. To capture the space of products we needed to abandon the spatial analogy. We were no longer looking at a geographic space, but a cognitive space linking knowledge and ideas. The forest analogy was brilliant, but to scientifically formalize it, I had to shed the metaphor and think in terms of networks.

After a few days I was able to produce a network representation of the forest using a software designed to visualize genetic interactions.<sup>1</sup> It worked perfectly for mapping the landscape of products defined by trade. This was not a coincidence.

Molecular biology data involves thousands of unique genes and proteins, and therefore, requires representations that can help us keep track of the elements involved and their patterns of interactions. Like a big Shakespearean play where each character plays a unique and well-defined role, genes and proteins are non-interchangeable, or non-fungible, just like products and the knowledge they require. Trade data is also made of thousands of non-interchangeable and unique categories, such as hot-rolled iron, calf skins, vulcanized rubber, and thousands more. So, both

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<sup>1</sup> Cytoscape

proteins and products benefit from representations that can preserve their categorical identity. Networks provide that representation.

After about a month, I had the first version of what would later become a popular network. A network where I could visualize the movement of the metaphorical monkeys by highlighting the products a country specialized in. A detailed image of an economy, that came not from a microscope or a telescope, but a *datascope*, that once properly oriented could be used to explore and explain decades of specialization patterns.

And like we expected, the monkeys moved in a way that was highly constrained by the shape of the forest. With our new *datascope* we could see how South Korea diversified during the 1970s, 80s, and 90s, as it entered several products in the electronics and machinery clusters. We could see Chile expanding from a few categories in fruits and fish to a larger variety of food exports. We could see Bangladesh's garment sector exploding as they entered dozens of unique types of apparel. We could see economic development, not as a line in a chart where GDP moved up the y-axis, but as a highly differentiated process, where thousands of sectors were present, and patterns of specialization were unique.

The deal with Ricardo was that we were going to work on two papers. I would lead a paper for a scientific audience, and they would lead a paper targeted at economists. I kept my side of the deal and completed a paper that was published in *Science*, on July 27, 2007.

### **Economic Complexity**

Two years later, during a cold, dark, and snowy winter evening, Ricardo and I were hanging out in his office at the Harvard Kennedy School. We now had a relationship that was marked by the success of our first paper and were more relaxed. On that particular day, we were not sure about what to do next. We wanted to do something together, but this time, Ricardo did not have a story about monkeys to tell.

So, we were tossing ideas. For a few years now I had been exploring economic data, so I started to complain about the fact that, while there were plenty of indicators for

countries, we had very few indicators to describe the products they made. Ricardo had worked on one of those indicators together with Dani Rodrik, an average of the GDP per capita of the countries that specialized in a product. The shortage of product level indicators seemed like an opportunity to me, since as a scientist, you don't want to look only under the proverbial lampposts that have been lit, but one in a while, you want to turn on a new one.

Since we had been working with trade data, the simplest indicator we could construct for a country was its diversity: a count of the number of products it specialized in. But what would the equivalent measure be for a product? I reasoned that the equivalent was the number of countries specialized in it. But since that was a bit of a tongue twister, we needed a name for it. I suggested "ubiquity."

The idea of ubiquity was simple enough, but I was standing next to the whiteboard with a dry erase marker and wanted to make a scatterplot where I could see all products. That meant I needed another variable for the y-axis. For countries it was easy, you could compare a country's diversity with its population, GDP, years of schooling, etc. For products, we had nothing. So, we started thinking about making a second measure to complete that chart. In hindsight, it feels obvious, but it probably took us about thirty minutes to an hour to come up with a solution. Eventually, I got the idea of just using diversity again. We could complete the chart by putting on the y-axis the average diversity of the countries specialized in a product. That was a bit more of a tongue twister, but it led to the idea that we could do the same for countries, putting diversity in the x-axis and the average ubiquity of the products they specialized in on the y-axis. I drew the two charts with on the tiny whiteboard and we reasoned about each of the four quadrants. Where would countries and products locate in these charts? We had no clue. We had to look at the data for that. So, on that day, we imagined they could land anywhere. A country far from both axes would be a country that made many products made also by many other countries. A country close to the origin made a few products that few other countries made. It was time to call it a day.

I went home to my studio apartment on the Riverway, near Harvard Medical School, sat on my bed, and opened my laptop. I loaded the data and made both charts. To our surprise, countries and products did not locate anywhere. Both charts looked a

bit triangular, since countries that made many products tended to specialize in those made by a few other countries. I put the charts together in a presentation, sent it by email to Ricardo and went to sleep.

Those first charts got the ball rolling. The problem here was that it was hard to continue moving forward using only words. The first variable for a country was diversity. That was easy. Then we had the average ubiquity of the products it was specialized in. That was a bit harder, but still, something you could say in a single breath. One step further resulted in the average diversity of the countries specialized in the same products.<sup>2</sup> Each step was getting harder to verbalize. We were getting stuck again.

A few weeks later, I stopped by my friend Jose Miguel Fernandez, a Chilean astronomer who was living in a house with five other roommates near Central Square. He and I had been study buddies during our undergrad in Chile. Now, we were in the last months of our PhDs. A few minutes before midnight I left Jose's house and began walking towards the Central Square subway station. During that walk, I had the *Aha!* moment we had been waiting for. We had to forget about language. Who cared about diversity or ubiquity, or countries and products. At the end of the day countries and products were just nodes in a network, and diversity and ubiquity were just words we were using to talk about the number of links each of them had. Going further just meant taking the average number of links of the first neighbors, second neighbors, and so forth. If we just thought about this in terms of networks, we could easily go on forever without having to verbalize infinity. That seemed a ludicrous way of thinking, but it turned out to be correct. I got back to my apartment, sat again on the top of my bed with my laptop, completed another presentation, sent it to Ricardo, and went to sleep. The good news was that after doing the same calculation about twenty times the numbers representing each country and product no longer changed. Infinity was not far away.

This “infinity” representation turned out to be quite interesting. Sorting countries by diversity produces a relatively obvious ranking where big and/or developed countries tend to be on the top. But in this new representation “smaller” but

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<sup>2</sup> Weighted by the inverse of the ubiquity of each of these products

sophisticated economies like Finland, Sweden, or Singapore bubble up. The problem was that it was going to be hard to convince economists to care about this particular number. The reaction we started to get from colleagues was: “But what is this?” “Is it education?” “Is it capital?” “Is it financial market access?” And the answer to all of those questions was, “well, no.” Our best intuition back then was that we were getting a measure that combined “all of the above,” all of the complementary things that need to be present at the same place for an economy to succeed. So as a physicist trained in networks and complex systems, I started calling this infinity representation a measure of “economic complexity.” Ricardo quickly adopted the name.

That summer I defended my PhD in physics at the University of Notre Dame and completed a full draft of the paper on “economic complexity” that I brought with me to Ricardo’s lab at Harvard, when I started to work officially at the Center for International Development (until that moment I had always collaborated with Ricardo as a PhD student at the University Notre Dame and had no direct employment relationship with him). Since I had found our measure of economic complexity correlated well with income, I shared the data with Ricardo to perform a regression explaining future economic growth. This showed that our new measure was a strong and robust predictor of the economic growth of countries. I wrapped up the paper by building a mathematical model that mechanistically explained the triangular relationship between diversity and ubiquity we had observed earlier and submitted the paper for publication. It found a home at the *Proceedings of National Academy of Sciences*, where it was handled by the Cambridge University economist Partha Dasgupta.

Unlike the product space contribution, which was easier to understand from the get-go, the idea of economic complexity was harder to grasp and, thus, was adopted more slowly. Not only was the concept more obscure, but in 2009, it was a bit ahead of its time. That infinity vector that I described earlier is what today we call an embedding, like the ones used by generative language models to describe words, but for countries and products. And while computer scientists and mathematicians had been using vectors to represent words since at least the 1980s, the idea of “word embeddings” only became really hot about five years later, when in 2013 a team of researchers at Google introduced the now famous Word2vec. That meant that for

most of our colleagues, there was no reason to believe that the “infinity” vector, or an economic “embedding” was anything more than a statistical curiosity.

Today, of course, we know better. We understand that the economic complexity index, or ECI, the name I proposed for the “infinity” vector in 2011, is equivalent to the “spectral embedding” of a matrix of similarities. We also know thanks to the work of some colleagues in Vienna and Rome that it solves a very fundamental problem<sup>3</sup>. Imagine you want to assign a number to each country and product such that the number you assign to each a country is the closest possible to the number you assign to each of its products. The solution to that problem is the economic complexity index or ECI.

After the publication of our paper, I went on one of the longest trips of my life. With a rollaboard, backpack, and Kindle filled with non-fiction books, I spent the summer of 2009 enjoying a European trip that was long overdue. I always wanted to spend a period of my twenties travelling Europe and I was now twenty-nine. Once I returned, I visited Ricardo in his office and told him that if we wanted our measure to be adopted, we should do our own report. Why wait for it to be adopted by the U.N. or the World Bank if we could write a report ourselves? He told me that this was not what we should be working on. To him, it was a bad idea.

## **Part II:**

### **The three strikes of Ricardo Hausmann**

#### **Strike 1**

That fall I started to look for faculty positions. I had a few good papers under my belt and was ready for the next step. I applied to both the Kennedy School and the MIT Media Lab. The Kennedy School offered me a Lecturer position and the Media Lab a tenure-track assistant professor job, so I chose MIT.<sup>4</sup>

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<sup>3</sup> Servedio, V. D., Bellina, A., Calò, E. & De Marzo, G. Economic Complexity in Mono-Partite Networks. *arXiv preprint arXiv:2405.04158* (2024).

<sup>4</sup> For the Kennedy School interview, Ricardo insisted—repeatedly—that I not present or mention any of the work we had done together (even though it was the most applicable to the school). So, I had to build a job talk without what I thought was my best work at the time.

The MIT Media Lab, which is known for interactive design, provided an interesting environment where I could develop an aspect of my work that I could not develop at the Kennedy School. During my PhD at Notre Dame, I had started exploring the idea of building data visualization and distribution websites. I had built a website with visualizations of the product space for all countries in 2006-2007, which I then updated in 2008 before I moved to the Kennedy School. In 2007-2008, I also built an interactive website visualizing disease co-morbidity networks (together with Nicholas Blumm) that we released in 2009<sup>5</sup>. At the Kennedy School I found little support for these types of projects. I wanted to expand the website I had built during my PhD into an interactive platform, but Ricardo considered online data visualization work “non-serious” and insisted that I did not waste my time on it or would simply change the topic. I tried to do something anyway using an abandoned desktop computer that was left behind in what became my office and installed Linux on it. But even getting an IP address from the Kennedy School was an ordeal that required me to meet a skeptical head of IT after many denied requests. I emphasized to Ricardo that I wanted to continue the online data visualization work I had started at Notre Dame, but he only warmed up to the idea once I got the offer to join MIT and was choosing between that or continuing with him at the Kennedy School. By then, I had met Alexander Simoes, whom I hired as my first graduate student at MIT, and Ricardo agreed to give him a low paid internship to work with me during my last summer at the Kennedy School (summer of 2010).

In August 2010 Alex and I joined MIT—Alex as my graduate student, me as a tenure track assistant professor. There, we could finally begin to make progress on building the platform I called The Observatory of Economic Complexity. During that first year, Alex and I tried multiple designs. Ricardo didn’t care that much about this project and avoided any conversations about user interface or graphic design like the plague.

About a year later, in 2011, Ricardo was pressed to show something at the annual meeting he hosted at the Kennedy School for his lab’s sponsors (GEM: Global Empowerment Meeting). So, he woke up to the idea of doing the report on economic complexity I had suggested to him during the summer of 2009. I was of course

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<sup>5</sup> We waited for the Plos Computational Biology paper to be accepted and published.



interested, and suggested that if we were finally going there, we should make it a colorful report filled with graphics, like the geographic atlases I enjoyed browsing during my youth. I suggested we should leverage the data visualization work that Alex and I were doing at MIT to create a two-page spread for each country, so we could fill up the book with graphics instead of words. Again, the name I propose for the report, *The Atlas*, stuck, and we started working on a print report that a few months later would become *The Atlas of Economic Complexity* (self-published in 2011 by Puritan Press, with the print run paid for by Harvard's Center for International Development).

But that was also when things began to get complicated. Making the report required teamwork, which I was happy to coordinate. Alex used the software we had built at MIT to produce all of the images for the country pages. Sebastian Bustos (from HKS) worked hard on the econometric models. Muhammed Yildirim helped with some of the math. I did the bulk of the writing and coordinated the work. But Ricardo became adamant that none of the junior contributors (e.g. Alex, Sebastian, Mohammed) should get credit as an author. It was going to be Hausmann and Hidalgo only<sup>6</sup> and other contributors would be shown only in the acknowledgements section (not as authors). Excluding the junior authors felt unfair to me, and of course, to them. As a physicist, this felt egregious (physics has a culture of promoting junior colleagues as authors). So as the second most senior author of the project, it became my job to advocate for the rights of the other juniors. Ricardo did not want to talk about it and would change the topic or cut me off with some derogatory remark (implying I didn't know what I was talking about). But I kept on pushing. He eventually sent the executive director of CID (Marcela Escobari) to talk to me. She called me on a Saturday, and after an hour-long phone conversation where she tried to repeatedly convince me that it was in my best interest to cut off the other junior authors, I eventually got her to agree on a deal where we would include the name of all junior authors in the back cover of the book in exchange for removing the logo of the MIT Media Lab from the front cover.

Late in October of 2011, the print version of the *Atlas of Economic Complexity* was released. Since there was no web development support at Harvard, and we needed a

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<sup>6</sup> He had already told me that he would never accept another publication in which I would figure as the first author. It had to be him.

website to house the PDF, in a last minute decision we released the print version of the book using the MIT server Alex and I were using to build the observatory, with the URL atlas.media.mit.edu (which today still redirects to oec.world). We made sure to include the name of all authors on the webpage. That URL also contained a link to an early version of The Observatory of Economic Complexity.<sup>7</sup> Below you can see a screengrab from October 24, 2011, available from the Wayback Machine, an online archive of the internet.

(October 24, 2011)

<https://web.archive.org/web/20111124223820/http://atlas.media.mit.edu/>

**THE ATLAS OF** | **ECONOMIC COMPLEXITY**  
MAPPING PATHS TO PROSPERITY

**Download PDFs**  
Full Version (364 Pages / 85.7 MB)  
In parts:  
Part I: Why, What and How & Rankings (91 pages / 8.2 MB)  
Part II: Country Pages (271 pages / 75.4 MB)

**Explore Interactive Visualizations**

Ricardo Hausmann | César A. Hidalgo | Sebastián Bustos | Michele Coscia | Sarah Chung | Juan Jimenez | Alexander Simoes | Muhammed A. Yildirim

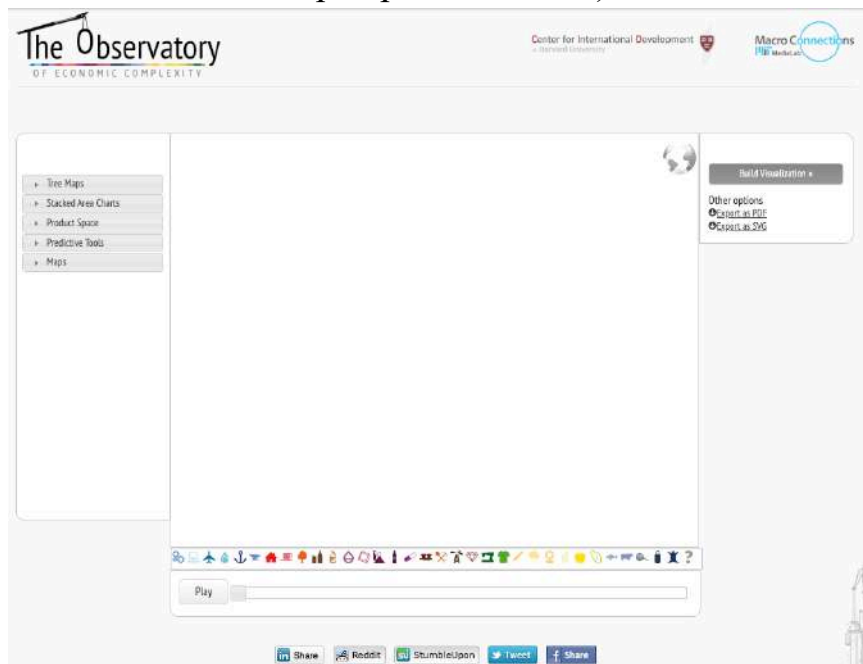
A collaboration between:

Center for International Development at Harvard University | HARVARD Kennedy School | MacroConnections | MIT

The “Explore Interactive Visualizations” link on the right leads to the OEC. Below is a screengrab from the OEC from the Wayback Machine on the same date (the visualizations in the center are not visible since the Wayback Machine only has a snapshot of the html of the project). Note that the OEC and the Atlas are projects with two distinct names (the Atlas is a printed book and the OEC is an online data exploration and visualization platform).

<sup>7</sup> The graphic design was produced with the help of the talented Ali Almosawi, at that time a graduate student at MIT, and iconography from Isabel Meirelles, at that time a graphic design professor at Northeastern University (who had taught Alex during his undergrad).

(<https://web.archive.org/web/20111228090241/http://atlas.media.mit.edu/app/tree-map/export/usa/2009/>)



Fighting to give credit to the junior authors was a challenging experience. But my hope was that it was an isolated event. Completing projects on a tight deadline is a stressful experience that can get the worst out of people. I was happy to collaborate with Ricardo and the release of the book went well. I didn't know it at the time, but this would become strike one.

## Strike 2

In March of 2010 I incorporated a company to do consulting work with Ricardo. At the beginning we did not have much activity, but eventually we started to get some traction. I developed an important lead soon after I joined MIT when I visited the state of Minas Gerais in Brazil. A group of publicly minded academics invited me to discuss their concern about the economic growth prospects of their state.

<b>Form SS-4</b> (Rev. January 2008) Department of the Treasury Internal Revenue Service		TCC Order Number: 329682 HYK <b>Application for Employer Identification Number</b> (For use by employers, corporations, partnerships, trusts, estates, churches, government agencies, Indian tribal entities, certain individuals, and others.) ▶ See separate instructions for each line. ▶ Keep a copy for your records.		OMB No. 1545-0043 EIN
1 Legal name of entity (or individual) for whom the EIN is being requested				
2 Trade name of business (if different from name on line 1)		3 Executor, administrator, trustee, "care of" name <b>Cesar A. Hidalgo</b>		
4a Mailing address (room, apt., suite no. and street, or P.O. box) <b>158 Magazine St. #36</b>		5a Street address (if different) (Do not enter a P.O. box.)		
4b City, state, and ZIP code (if foreign, see instructions) <b>Cambridge, MA 02139</b>		5b City, state, and ZIP code (if foreign, see instructions)		
6 Country and state where principal business is located				
7a Name of principal officer, general partner, grantor, owner, or trustor <b>Cesar A. Hidalgo</b>		7b SSN, ITIN, or EIN		
8a Is this application for a limited liability company (LLC) (or a foreign equivalent)? <input type="checkbox"/> Yes <input type="checkbox"/> No		8b If 8a is "Yes," enter the number of LLC members		
9c If 8a is "Yes," was this LLC organized in the United States? <input type="checkbox"/> Yes <input type="checkbox"/> No				

*EIN application for Growth Ventures LLC*

About a year later, the team in Brazil was ready to start talking about a project focused on building an economic data visualization platform similar to the one that Alex and I were building at MIT. I brought this relationship to Ricardo and he insisted we invited Marcela Escobari into the company, by giving her 20% of the shares (originally the company was fifty-fifty between Ricardo and me, so it now became 40-40-20). We also got a lead with a group from the Netherlands who wanted a report on economic complexity in the Dutch economy (which I also worked on and helped complete).

All was well, until our 2012 taxes had to be paid. From our accountant, I learned that Marcela and I had made about the same amount of money from the company and that Ricardo had made about twice what I made (even though we were equal partners, and I had helped bring in and worked on all the deals). There was never a discussion about how money was going to be distributed until that moment (I assumed based on shares, since we were not drawing salaries), so I asked Ricardo and Marcela to please explain. In a usual power move, he invited me to his house to explain me how things worked. Marcela was there too.

Sent: Thursday, April 12, 2012 4:25 PM

To: Karl Schramek

Cc: Cesar A. Hidalgo

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Date	Type	Num	Adj	Name	Account	Split	Amount	Balance
<b>Guaranteed Payment - Escobari</b>								
05/22/2011	Check	1		Marcela Escobari	Guaranteed Payment - Escobari	Bank of America #7123	5,000.00	5,000.00
06/06/2011	Check	10		Marcela Escobari	Guaranteed Payment - Escobari	Bank of America #7123	7,000.00	12,000.00
06/29/2011	Check	16		Marcela Escobari	Guaranteed Payment - Escobari	Bank of America #7123	7,500.00	19,500.00
09/20/2011	Check	33		Marcela Escobari	Guaranteed Payment - Escobari	Bank of America #7123	14,000.00	33,500.00
12/07/2011	Check	43		Marcela Escobari	Guaranteed Payment - Escobari	Bank of America #7123	9,750.00	43,250.00
12/27/2011	Check	45		Marcela Escobari	Guaranteed Payment - Escobari	Bank of America #7123	13,000.00	56,250.00
<b>Total for Guaranteed Payment - Escobari</b>							<b>\$56,250.00</b>	
<b>Guaranteed Payment - Hausmann</b>								
05/20/2011	Check	2		Ricardo Hausmann	Guaranteed Payment - Hausmann	Bank of America #7123	10,000.00	10,000.00
05/24/2011	Check	6		Ricardo Hausmann	Guaranteed Payment - Hausmann	Bank of America #7123	15,000.00	25,000.00
07/05/2011	Check	10		Ricardo Hausmann	Guaranteed Payment - Hausmann	Bank of America #7123	15,000.00	40,000.00
07/26/2011	Check	28		Ricardo Hausmann	Guaranteed Payment - Hausmann	Bank of America #7123	12,000.00	52,000.00
09/13/2011	Check	32		Ricardo Hausmann	Guaranteed Payment - Hausmann	Bank of America #7123	15,000.00	67,000.00
11/07/2011	Check	40		Ricardo Hausmann	Guaranteed Payment - Hausmann	Bank of America #7123	15,000.00	82,000.00
12/14/2011	Check	53		Ricardo Hausmann	Guaranteed Payment - Hausmann	Bank of America #7123	8,000.00	90,000.00
12/14/2011	Check	51		Ricardo Hausmann	Guaranteed Payment - Hausmann	Bank of America #7123	9,500.00	99,500.00
12/14/2011	Check	48		Ricardo Hausmann	Guaranteed Payment - Hausmann	Bank of America #7123	19,850.00	119,350.00
<b>Total for Guaranteed Payment - Hausmann</b>							<b>\$119,350.00</b>	
<b>Guaranteed Payment - Hidalgo</b>								
05/25/2011	Check	7		Cesar Hidalgo	Guaranteed Payment - Hidalgo	Bank of America #7123	10,000.00	10,000.00
07/08/2011	Check	22		Cesar Hidalgo	Guaranteed Payment - Hidalgo	Bank of America #7123	10,000.00	20,000.00
07/08/2011	Check	23		Cesar Hidalgo	Guaranteed Payment - Hidalgo	Bank of America #7123	10,000.00	30,000.00
07/08/2011	Check	21		Cesar Hidalgo	Guaranteed Payment - Hidalgo	Bank of America #7123	18,000.00	48,000.00
12/19/2011	Check	50		Cesar Hidalgo	Guaranteed Payment - Hidalgo	Bank of America #7123	5,500.00	53,500.00
12/19/2011	Check	52		Cesar Hidalgo	Guaranteed Payment - Hidalgo	Bank of America #7123	6,000.00	59,500.00
<b>Total for Guaranteed Payment - Hidalgo</b>							<b>\$69,500.00</b>	
<b>TOTAL</b>							<b>\$235,100.00</b>	

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The conversation was more or less like this (and I paraphrase). *“You see Cesar, you don’t understand.” “When you had a client, you were free to tell us about that client, and we were free to accept that business. And when we had a client, we were free to not tell you about our clients, and free not to share with you that part of the business. So, last year, we had some clients that we did not tell you about. But there is nothing wrong with that, because you were free to tell us and to share and we were free not to tell you and not to share.”*

Of course, that sounded like a bunch of bull. It was a sharp and uneven practice that involved deliberately concealing important information about the company from me for his own benefit. But it was April 2012 and Alex was about to graduate from MIT. I had promised him a job that depended on the Brazil contract I had brought to that company. So, I turned the other cheek. That was strike two.

Meanwhile, Alex and I had made important progress with the OEC. Alex dedicated the two full years of his master’s to the project, and I worked side-by-side with him as his supervisor. We slowly extended the number of visualizations, which was something that required changing our backend infrastructure and generalizing our frontend design. After meeting with people at Google and discussing search engine optimization strategies, we added *profile* pages to help search engines understand the content of the website (a profile is a long page with multiple visualizations designed for search engine optimization and easy exploration). This continued effort, which included also translating the OEC to 10+ languages, paid off. The traffic to the OEC grew and it slowly started to leave the 2011 printed book behind.

Later in 2012, Ricardo finally realized that the data visualization work I had been pushing on him for more than five years was not such a lowbrow idea. He now wanted CID to start contributing more to the web development of the project. So, Alex and I helped Ricardo find a programmer he could hire to support the effort (a college friend of Alex). Since Ricardo did not know how the OEC worked, or about user interface design, the programmer, Eric Franco, spent most of the week at my lab at MIT.

But as Alex’s graduation became imminent things started to get really weird. Alex began to receive phone calls from Marcela telling him that (and I paraphrase): “A

*decision has been made and, and you need to move the Observatory immediately to Harvard.*” After each of these phone calls Alex would reach out to me and asked me if we had made that decision. And I would tell him the truth: that nobody had talked to me about any of that or invited me to any meeting to discuss moving the project away from MIT (where the project had been built and was hosted by a good infrastructure). So, I would reach out to Ricardo and ask him what was going on. And he would tell me (and I paraphrase): *“this type of petty website project is below my paygrade. I don’t know what you are talking about.”* But the calls kept coming and my friends at the Kennedy School confirmed that something was up. Also, an empty URL appeared at atlas.cid.harvard.edu (remember we had atlas.media.mit.edu).

Late in 2012, we arrived at the first breaking point. I decided to confront Ricardo outside the elevators of the Cambridge Innovation Center, where we had a small office where Alex was working on the Brazil platform together with Dave Landry (a former classmate of Alex from Northeastern who had worked with me and Alex in a previous data visualization project (the HDI Tree) and whom we hired to work on the Brazil project). I told Ricardo that I was happy to continue collaborating with him and his team and to continue including them as contributors to the Observatory, but that trying to move the Observatory to Harvard, especially behind my back, was not nice. So, he had a choice. He could either continue having a relationship with me or steal the Observatory. But he couldn’t have both. He stared at me directly for about 30 seconds without saying a word. He turned around and walked away.

Things were not going well between us. Still, a part of me held on to the idea that we could turn things around—that Ricardo would understand that the Observatory was not a project that he had ideated, started, or designed. That I valued his role as a collaborator and that he could support me as the lead of the project, as I supported him in many of the project he led. I assumed he understood that this was not a project that I built for him, but one he had joined—because he certainly never asked me to build it. On the contrary, he repeatedly told me to stay away from this type of work.

But then, he crossed the line again.

On March 27, 2013 I received an email from Marcela Escobari entitled “The Observatory.” The email included a three-page document they had prepared for an external audience presenting The Observatory as a Kennedy School project. The letter was not written as a joint project between his group at Harvard and my group at MIT. It was written as the project was theirs and we were helping them build it (the only mention of my group was on page 2). So, I fired back an email telling Ricardo and Marcela that I was deeply hurt about this situation; that this was a project that Alex and I had developed at MIT; that I would not simply release creative control of the project at their request; and that I was ready to break up with them over it.



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**The Observatory**  
A Powerful Online Interactive Tool

***The Center for International Development at Harvard University (CID)***

What allows countries to grow? What can be done to accelerate growth in each country? CID's Growth Lab is committed to solving these mysteries and articulating the policy implications that emerge. Over the past six years, the Growth Lab has developed innovative theories of growth—*Growth Diagnostics, Structural Transformation, Economic Complexity*—that are transforming the way the development community thinks of the growth process and revolutionizing the way major international institutions are thinking about aid, growth, and industrial development.

***What is The Observatory?*** Our new theories show that countries grow, not by specializing, but rather by diversifying their economies. The opportunities for diversification are strongly affected by the initial set of productive capabilities existing in a country. **The Observatory** ([www.cid.harvard.edu/atlas](http://www.cid.harvard.edu/atlas)) is a data-rich resource that, based on each country's unique productive capabilities, maps out the feasible set of products they could diversify into in order to grow and prosper.

The Observatory is a powerful interactive tool that helps us orient ourselves in a space that is immensely complex. It enables policy makers, entrepreneurs, academics, students, and the general public to understand the competitive landscape of each country and to map the path of diversification and prosperity for 128 countries. The Observatory can create over a million visualizations on demand showing the existing export dynamics amongst countries and the potential new industries available to each location. Since its launch in October 2011, The Observatory has received 140,000 unique visits from around the world, all without any promotion.

***Why is The Observatory important?*** This on-line tool makes CID's analysis and its underlying data accessible to anyone with a computer or tablet. The tool allows users to explore growth opportunities by country and industry, with the potential to provide input into economic policy and private investment decisions. The analysis may also be used in many other ways: to inform the agendas of development banks in policy recommendations and loan programming; by an entrepreneur developing a market plan; by an investment promotion agency pitching a new factory; by students working to understand solutions to development challenges in a country; as well as guide other choices we have yet to imagine.



Ricardo fired back an email filled with imprecise claims about the origins of the Observatory, claiming this was a project I had started at Harvard under his supervision, ignoring the more than a half-a-decade history on online data visualization efforts that started when I was Notre Dame and became intense only after I moved to MIT. He also gaslighted me by calling me paranoid. I answered each of his points, but before I sent my reply, I received an email from Marcela trying to patch things up. She was asking for a meeting. So, I decided to give the relationship another chance and agreed to meet with them at a neutral place. I never heard back from them. Instead, they put the Observatory online at a Harvard domain. When I saw that, I called Ricardo on the phone and told him I never wanted to see him again.

Ricardo used the fact that we had a very permissive open-source license (an MIT license) that allows anyone to build on the code, to take the Observatory against our will, without our consent, and with full knowledge that this would destroy our relationship. Below you can find a screen capture of the April 8, 2013, version of Harvard's "Atlas Online." And a February 15, 2013, screen capture of the MIT Observatory of Economic Complexity. As you can see, they are identical. Notice that "atlas.cid.harvard.edu" is not called "The Atlas Online," but "The Observatory of Economic Complexity" as I had named it at MIT. Also notice that the top-level navigation includes a link called "Profiles," a fact that would become important for an act of plagiarism that Ricardo and his team committed six years later, in 2019, when they claimed to introduce country profiles as a first-of-its-kind feature.

Ricardo's original Harvard "Atlas," when it was still called *The Observatory of Economic Complexity*



BackMachine <http://atlas.cid.harvard.edu/> Co MAR APR 08 SEP 2012 2013 2014 About

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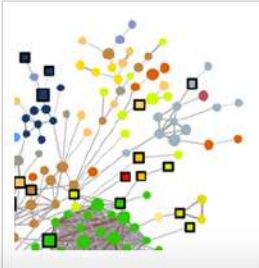

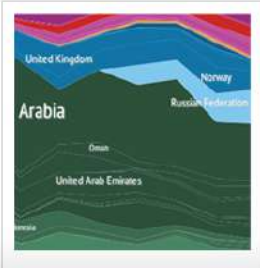
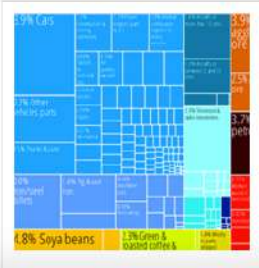
Watch the video for a brief introduction of how The Observatory works.



about CHILE and WINE!

01:57 | vimeo

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The original MIT Observatory of Economic Complexity ([atlas.media.mit.edu](http://atlas.media.mit.edu)) on February 15, 2013.

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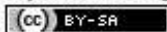
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Explore More Apps

Also, notice the text of the footer of the “Harvard” website, which says “The Observatory of Economic Complexity by Alexander Simoes,” as it had said for about 18 months by then. In fact, the link to the permissions document redirected still to the MIT site. Legally, there was nothing we could do. The site was technically open source. But that didn’t make this misappropriation proper or right. That was strike three, but it was not the last one.

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Permissions beyond the scope of this license may be available at <http://atlas.media.mit.edu/about/permissions/>.



## **The aftermath**

This break meant that Alex, Dave, and I were going to have to execute the entire Brazil project on our own. That was OK. We knew what we were doing. Still, Ricardo tried to tank the project by being rude and standoffish to the people who came from Brazil and visited him at the Kennedy School. But the Brazilian team was happy with us, and we were happy with them. We successfully completed the project without missing the November 2013 deadline. I came up with the name “Data Viva,” to evoke the idea of data coming alive.

Once the project was over, I asked Ricardo and Marcela to give Dave and Alex a bonus for their work. Our company, Growth Ventures, was closing because of our break-up and there was plenty of money left (over \$150,000 from the Data Viva project). Alex and Dave had worked hard to bring the project to completion without delay. But of course, their choice was again, the freedom to not share. So, Ricardo and Marcela made around \$100,000 from a project they did not contribute much to. Ricardo was also petty enough to ask to divvy up the “technology assets” of the company, basically the two laptops we bought for Alex and Dave and a couple of computer screens. I thought Alex and Dave deserved something for their efforts, so I split my profit into three equal parts and shared it with them.

From that moment on, Ricardo and I went our separate ways. We signed an MOU to separate the Observatory from the Atlas, giving each team a separate copy. We closed Growth Ventures LLC and I started a new company with Dave and Alex as equal partners (Datawheel LLC). Since then, we have built over 20+ data distribution platforms like the OEC. With Datawheel, we started a new contract with Brazil to work on the 2.0 version of DataViva, centering its design on the idea of profiles.

Alex, Dave, and I built a completely redesigned version of DataViva that we released in 2014. But in 2015, I learned Ricardo was presenting this version of DataViva, a version he had not contributed to, as his own project to executive education students at the Harvard Kennedy School. That was also around the time where he sold a multimillion-dollar project to Mexico (rumored to be about 5M USD) via an undisclosed escrow that resulted in a website so embarrassingly bad some local

authorities nicknamed it “El Mamarracho.” This web thing that he derided for about a decade was becoming good business for him.

But who cares, I had my own things to worry about. When Ricardo betrayed me multiple times, my wife and I were expecting our daughter, and on top of my academic obligations, I was building a business and writing a trade book. So, my strategy was to ignore him. But the misappropriations kept coming.

In 2019, I received an email invitation to an event where Ricardo would “introduce: Country Profiles, a first-of-its-kind platform” that was of course something we had been doing since at least 2012 (and that he knew about). More recently, in 2024, he put online two working papers claiming to introduce ideas we had published in peer-reviewed publications in 2023 and that we had made available online in 2022 (and that he also knew about).

This involved two working papers at the World Intellectual Property Organization (WIPO). The first one claimed to introduce “multidimensional economic complexity,” an idea my co-authors and I published in 2023 in a peer-reviewed journal and that Hausmann and his co-authors were perfectly aware of. Hausmann’s working paper claims to “introduce” and “extend concepts from the economic complexity framework on trade to [...] scientific publications and patents” and concludes that these metrics are complementary when explaining future economic growth. This was exactly what we did in our 2023 peer-reviewed paper (Stojkoski et al. 2023, published in *Communications, Earth, and Environment*). But instead of giving proper acknowledgement to our work, Hausmann et al. hid it in a footnote on page 18 clouded in the factually incorrect statement: “other studies have developed similar complexity metrics under different names.” That is not true. Our 2023 paper used the *same* name and methods used in Hausmann’s 2024 “new” working paper, namely, the “Economic Complexity Index (ECI).”

Of course, this could be a misunderstanding. But we found clear evidence to the contrary in two other working papers. One of them, another WIPO working paper by many of Hausmann’s coauthors, but not him, acknowledges our work in multidimensional economic complexity in the main text: “Following [...] Stojkoski

et al. (2023).” So, Hausmann’s co-authors clearly knew about the work (one of them was also a discussant of our multidimensional paper at a workshop in 2022).

And there is a third working paper at WIPO with Hausmann as a first author calling for the use of multidimensional economic complexity methods in innovation policy that cites his own 2024 working paper as the only example of prior art, completely ignoring the 2023 peer-reviewed paper he knew about (“In Hausmann et al. (2024), we measure this for each country in different dimensions (e.g., trade and patents).”). Sadly, I had already made a similar call for multidimensional expansion of the field in a paper that was peer-reviewed and published in 2023 in *Research Policy* and that had been available online (as a pre-print) for two years. In that paper, I cite our original multidimensional economic complexity contribution and also two other papers that had introduced multidimensional approaches to relatedness, another key concept in the field, which Hausmann does not cite either. Together, these three papers show an attempt by Hausmann to appropriate an idea published by a former co-author with full knowledge of the existence of such previous work.

The story of my collaboration with Ricardo Hausmann started well but became marred by moments of betrayal and frustration. I value those initial moments and recognize that the hardships and conflicts that came later were not in vain. We were good friends at some point. I visited his home often and he invited me to his family events, like his daughter’s college graduation. He was also a guest at my wedding and was the first one to dance with my mother-in-law after me at the wedding. But experiences like these change you profoundly. Losing the trust that you give is much harder than never trusting at all. I still strongly believe in the power of collaboration and the transformative potential of interdisciplinary work. But I've learned the painful but valuable lesson that not all collaborations work well. At some point, you need to learn to let go.

As I move forward, I carry these lessons with me, striving to create impactful interdisciplinary work. The path may have been rocky, but it has also been enlightening. And so, I continue this journey with a renewed sense of purpose, dedicated to advancing knowledge and fostering genuine collaboration with the goal of producing meaningful work.