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Preface

A Note from the Editorial Board

The editorial board, comprised of Yazid Alfata, Jonathan Berke, Marton Gal, Sam Jordan, and Parham Yousef Gorji, dealt with the arduous task of deciding which journal articles were accepted for publication. Although we received many fantastic papers from dedicated students at universities around the state, we unfortunately can only publish a limited amount of papers. The authors of accepted papers are paired off with editorial board members to ready the paper for publication. Additionally, the board serves as a government body for the journal, and helps set rules and precedent for continuity.

We would like to thank Alex Major, the Economics department, and the alumni for your continued support.

Sincerely,
Jonathan Berke on behalf of the Editorial Board
A Note From the Submissions Liaison

We have selected five papers from among the many submissions by students of economics in colleges all throughout the state. The breadth of scholarship on display again fascinates us, and we are lucky to have read it.

The journal’s standard organization is intended to give as much attention as possible to the published papers, which are presented without abstract. However, the stylized facts that are the subjects of economic analysis do not exist in a vacuum. As the world does not stop while journal editors deliberate, two of these articles are presented with notes concerning developments in their subject matter that have come about during the creation of the journal.

This second edition of the Massachusetts Undergraduate Journal of Economics is the first of many efforts to pick up and carry on a standard established by students past. This sort of collaborative production has been an educational experience in itself, not only for the technical knowledge gained, but for the experience of creating a journal and developing the process throughout, as old friends leave and others take up where they have left off. Rather than breeding intertemporal coordination failures we trust that we can marshal our mistakes and our successes to facilitate a process that will outlive us.

Alex Major
Submissions Liaison and Head of Publication Working Group
Massachusetts Undergraduate Journal of Economics, 2013-14
Chapter 1

A Report on Russia’s Current Natural Gas Trade, Its Effect on the Russian Economy, and Future Market Trends
Nikitia Geovanis, University of Massachusetts, Amherst

This article was written in 2013, before our publication deadline, and does not address the Ukrainian Euromaidan movement, the impeachment of President Viktor Yanukovych, separatist actions in eastern Ukraine, or the current state of Russian and NATO involvement. Eurasian oil market behavior and the international political economy are very closely related, and predictions of market trends will probably have to be revised. Nevertheless, this article offers a compelling snapshot of a future battlefield yet at peace. -AM

ngeovanis@umass.edu
CHAPTER 1. GEOVANIS – RUSSIAN GAS

Introduction
The Russian Federation is a leading figure in world energy and a major participant in international energy markets. The dynamics of Russia’s energy sector directly impact the stability of its economy. Due to this, both utilizing and expanding the production of the land’s vast resources are crucial elements of national success. Natural gas is an essential resource for Russia’s energy sector. The nation has the most proved reserves of natural gas in the world, as well as being the world’s largest gas exporter (CIA, 2014). Natural gas is measured in trillion cubic feet (Tcf), and to give you a numerical perspective on Russia’s revenues from international gas trade, European nations are charged from around 9 to 15 billion dollars for every 1.0 Tcf of gas (Adamanis 2013). Russia is certainly an indispensable contributor to world natural gas markets, but to what extent and how? This study examines Russia’s stake in the international gas market, to inspect how its natural gas sector is structured, and to emphasize the most prominent developments in the gas market that will have a great effect on Russia’s economy.

Preface
Tcf stands for trillion cubic feet. To give you a numerical perspective of Russian revenues for each Tcf of natural gas sold I have chosen to present the possible minimal and maximum revenues. According to data on Russian natural gas prices in
2012, we can observe a wide variation of prices for different European nations. This range is from around $330 to $525 per thousand cubic meters. Evaluating these revenues in terms of Tcf of natural gas, we calculate a range from about 9 to 15 billion dollars for every 1.0 Tcf of gas. I mention this, so that the reader can get an accurate interpretation of added revenues due to any increase in Russian natural gas (in terms of Tcf of gas).

In North America BTU (British thermal unit) is the leading energy measure for dry natural gas, and especially for LNG (liquefied natural gas). 1 million BTU is approximately equivalent to 1.055 GJ (gigajoule). As the U.S. has become a prominent addition to world LNG markets in recent years, its cargo is measured in British thermal units and sent around the world. Russia’s average gas sales price in Europe has recently fluctuated around $10 per million Btu.

Current and historical analysis of Russia’s natural gas trade

Overview of Russia’s natural gas trade with the European Union

In the latter portion of the 20th century, the demand for natural gas in France, Italy, Germany, and many other EU (European Union) nations began to exceed domestic production (Ismayilov 2013). This constituted a growing market for gas trade with promising returns. The Netherlands, Norway, and the Russian Federation began increasing their export capacities
CHAPTER 1. GEOVANIS – RUSSIAN GAS

with new facilities and pipelines. Such shifts in European energy markets had no effect on some of the Union’s nations like the United Kingdom, for example. The UK was able to sustain itself with domestic production, remaining a gas island with no need for imports (Paltsev 2012). However, this changed as natural gas supply options became more accessible and less expensive through the development of a complex transportation system for natural gas in Europe (Ratner et al. 2013). Another reason for this change can be attributed to the fact that the North Sea gas reserves, United Kingdom’s primary site for gas exploitation, have already been more than half-depleted (Ismayilov 2013). Recent diversion from domestic production in the UK has lead gas imports to account for 45% of total domestic demand in 2009, and an increase of imports by 250% from 2005-2012 (BP 2013). Looking beyond the UK, at several other EU nations, we can observe similar cases of increasing imports. A politically significant and economically substantial issue, which has had a direct effect on increasing imports of gas to EU-27 members, is the concern over reaching ambitious targets of reduced CO2 and greenhouse gas emissions (Ismayilov 2013). As the expansion of cleaner energy production in the European Union is likely to continue, the use of natural gas will inevitably rise, since it produces much lower levels of harmful emissions compared to other traditional energy sources (Olivier et al. 2013). Being the world’s largest holder of proven natural gas reserves and also the largest producer and exporter of dry natural gas, Russia has taken its rightful place as one of the European Union’s most indispensable gas providers.

The energy sector, including natural gas, is one of the driv-
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Figure 1.1: EU Energy Consumption of Russian Natural Gas

<table>
<thead>
<tr>
<th>European Country</th>
<th>Primary Energy</th>
<th>Natural Gas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Austria</td>
<td>12.8%</td>
<td>52.2%</td>
</tr>
<tr>
<td>Belgium</td>
<td>10.0%</td>
<td>43.2%</td>
</tr>
<tr>
<td>Bulgaria</td>
<td>13.6%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Croatia</td>
<td>9.4%</td>
<td>37.3%</td>
</tr>
<tr>
<td>Cyprus</td>
<td>0.0%</td>
<td>6.9%</td>
</tr>
<tr>
<td>Czech Republic</td>
<td>14.2%</td>
<td>89.5%</td>
</tr>
<tr>
<td>Denmark</td>
<td>0.0%</td>
<td>6.0%</td>
</tr>
<tr>
<td>Estonia</td>
<td>8.0%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Finland</td>
<td>10.8%</td>
<td>100.0%</td>
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<tr>
<td>France</td>
<td>2.7%</td>
<td>17.2%</td>
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<tr>
<td>Germany</td>
<td>8.7%</td>
<td>39.9%</td>
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<td>Greece</td>
<td>7.2%</td>
<td>54.8%</td>
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<td>Hungary</td>
<td>9.9%</td>
<td>49.5%</td>
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<td>Ireland</td>
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<td>Italy</td>
<td>7.5%</td>
<td>19.8%</td>
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<tr>
<td>Latvia</td>
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<td>Lithuania</td>
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<td>Luxembourg</td>
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<td>Malta</td>
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<td>6.0%</td>
</tr>
<tr>
<td>Netherlands</td>
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<td>58.8%</td>
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<tr>
<td>Poland</td>
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<td>Portugal</td>
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<td>Romania</td>
<td>8.8%</td>
<td>24.2%</td>
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<tr>
<td>Slovakia</td>
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<td>63.5%</td>
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<tr>
<td>Slovenia</td>
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<td>57.9%</td>
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<tr>
<td>Spain</td>
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<tr>
<td>Sweden</td>
<td>1.5%</td>
<td>100.0%</td>
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<tr>
<td>United Kingdom</td>
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Graphic created by CGS. Data are not necessarily authoritative.
CHAPTER 1. GEOVANIS – RUSSIAN GAS

ing forces of Russia’s economy. The development of this sector has propelled Russia’s economic recovery following the collapse of the Soviet Union in the 1990s. Today, the Russian Federation plays a most important role in the energy supply of the European Union. In 2012, the EU-27 imported about 11.0 Tcf of natural gas, 19% of which was in the form of LNG (Ratner et al. 2013). These imports accounted for 64% of the total natural gas supply in EU nations that year. Natural gas sent from Russia made up 34% of the 11.0 Tcf, only surpassed by Norway at 35% (Ratner, Michael et al). However, six nations from the European Union, including Sweden and Finland, exclusively import gas from Russia. This gas accounts for 100% of their natural gas energy consumption, as seen in Figure 1.1. These nations tend to import more natural gas than they are able to use for energy production. This is done in order to re-export the natural gas to other countries within the European Union. Figure 1.1 also shows that Russian natural gas makes up half of the total energy consumption of Lithuania and closer to 9-25% for the rest of the EU’s members. It is important to note that the nations of Eastern Europe consume relatively little natural gas compared to other European countries, only about 14% of total energy consumption in the EU. However, their use of imported Russian natural gas is proportionally high (Ratner et al. 2013).

Conversely, Europe has played a very important role in Russia’s economy. This was especially true in 2007 under conditions in which about 25% of oil and 40% of natural gas consumption in the European Union were provided by Russia (Ismayilov 2013). Exports to Europe are a crucial element of profitability for Rus-
Russia’s international trade, particularly in the case of natural gas. Domestic consumption of natural gas in Russia is heavily subsidized, and because of this its price is significantly lower than international prices (EurActiv. 2012).

A Congressional Research Service report on the energy trade in Europe (Ratner, Michael et al. 2013) predicts that there will be a rising market for the importation of natural gas, especially in Germany. This is due to Germany’s recent policy decisions to phase out the use of nuclear power plants by 2020. Several EU members have also instituted policies that prohibit the development of shale gas due to environmental concerns that are associated with its extraction (Ratner et al. 2013).

Natural gas pipelines into Europe

Figure 1.2 shows the main Russian gas pipelines in Europe. We can observe a highly complex system of gas energy transmission. Out of 52 major international gas pipelines in Europe, Russia only owns three. However, these three pipelines supply the European Union and other European nations with merely a fraction of the total Russian natural gas exports. The rest are sent through transit countries, such as Ukraine and Belarus.

Russia exports a total of about 3.74 Tcf in natural gas to the EU. The Nord (North) Stream pipeline that stretches across the Baltic Sea transfers 0.97 Tcf of natural gas and the Yamal-Europe pipeline that runs through Belarus transports 0.6 Tcf of natural gas (Ismayilov). The rest is currently delivered through Ukraine by two major pipelines running alongside each other: “Bratstvo” (Russian for “brotherhood”) and “Soyuz,” both par-
Figure 1.2: Map of Major Russian Pipelines into Europe
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tially owned by Ukraine. We can observe both in Figure 1.2, in which the Brotherhood line is not labeled, yet it flows right above “Soyuz”. In 2010, before the Nord Stream pipeline had been assembled, 80% of the total Russian gas exports destined for Europe were transported through Ukraine. However, due to unstable Russian-Ukrainian relations that resulted in the gas crises of 2006 and 2009, Gazprom has made an effort to diversify the supply of Russia’s natural gas to European nations. This effort can be observed in the case of the Blue Stream, Nord Stream, and South Stream pipelines, all of which circumvent the Ukrainian borders in order to secure reliable supply of natural gas to European states.

The “Bratstvo” pipeline was established in 1967. It currently passes through Ukraine, Slovakia, the Czech Republic and supplies Germany, Austria, northern Italy, France, Switzerland and Hungary with Russian natural gas (Gazpromexport). The Yamal-Europe pipeline, commissioned in 1997, was only finished in 2005 when it reached its full production capacity of 1.16 Tcf (Ismayilov). In Figure 1.2 we can observe how the natural gas pipeline stretches from the West Siberian fields (the Yamal fields) of Russia to Europe. Gazprom’s Yamal-Europe II project, designed to add 0.53 Tcf to the Yamal-Europe export capacity, may soon be appointed a project initiation date (Gazprom 2013e). The Blue Stream pipeline lies southeast of the South Stream pipeline, as depicted in Figure 1.2, and connects Russia to Turkey. In 2012, out of a total of 0.87 Tcf of Russian natural gas exported to Turkey, the Blue Stream accounted for 0.52 Tcf, rising by about 55% from 2010 (Gazprom. Blue Stream). The first branch of the Nord Stream pipeline
was opened in November of 2011 with a supply capacity of 0.98 Tcf of natural gas. The proceeding year, a second string of the pipeline was placed, doubling its capacity to 1.96 Tcf. At 759 miles in length, the Nord Stream is currently the longest underwater pipeline in the world, connecting Russia to Lubmin, Germany, which then supplies other EU states (Chyong, Chi Kong et al. 2010). The South Stream gas pipeline with a capacity of 2.22 Tcf is expected to be finished in 2014 and will link the Russian Federation and Bulgaria through the Black Sea and cross onshore to Serbia, Hungary, and Slovenia (Gazprom. South Stream).

Something to keep in mind is the high fixed cost of each pipeline. For example, the initial price of the Nord Stream pipeline was $15 billion, which ultimately rose to $20 billion before the project was finished. The South Stream is even more expensive, with estimated costs of $20 to 25 billion (Chyong, Chi Kong et al). Russian gas pipeline projects are not the only ones that fall within such high price ranges, as, for example, the Turkmenistan-China pipeline costs about $15 billion. These tremendous costs are, however, offset by even greater export revenues. For example, in 2008, when prices had peaked, Russia’s natural gas export revenue was $69 billion. However, this revenue was reduced to $42 billion in 2009, most likely due to the global financial collapse (Chyong, Chi Kong et al).
Overview of Russia’s natural gas trade with non-EU members

The IEA (International Energy Agency) estimates that 63% of all natural gas imports into the European region, about 4.6 Tcf, come from the Russian Federation (IEA. 2013). According to this, Russia supplies Europe with about 25% of its total gas consumption (using data from BP. 2013 on European gas consumption). Russia also supplies European countries that are not part of EU-27 with about 30% of their total gas imports (BP. 2013). Russian gas exports to Turkey and former Soviet Union nations like Ukraine, Belarus, and others account for 1.98 Tcf of natural gas transferred through various pipelines in 2012 (IEA 2013).

It is possible that by 2020, Europe’s reliance on imported natural gas from Russia could reach a staggering 70% (Paltsev 2012). This could happen if domestic energy production in Europe continues falling, as it did from 2000 to 2010 (by a total of 3.87 Tcf), and if European natural gas consumption increases (Paltsev 2012). Such an increase is very likely because European nations continue to invest in lowering their greenhouse gases emission levels, which have continuously fallen since 1990 (Olivier et al. 2013). Overall, relative to exports of Russian oil, the natural gas trade has been unsuccessful due to the monotony of production and consumption rates since 1991. The European Union’s natural gas consumption grew, on average, by about 2% every year from 1990 to 2010 (IEA 2013). Even with the largest natural gas reserves, Russia has seen little fluctuation in its gas share in Europe. This is perhaps due to an increasing
availability of gas suppliers from North Africa and the Middle East.

In Asia, however, natural gas consumption has been growing much more rapidly than in Europe. In fact, consumption of gas has doubled from about 10 Tcf in 2000 to about 20 Tcf in 2010 and has continued to rise steadily (Paltsev 2012). Asian markets are also expected to maintain prices that are higher than in Europe and North America (Paltsev 2012). The lack of storage facilities, however, may cause more market volatility as prices could surge during peak demand seasons. Based on this market prediction, there have been recent indications for Russia to take a more aggressive role in expanding its market share for LNG.

In 2009, Russia commenced providing Asian markets with natural gas in the form of LNG, primarily to Japan and South Korea. Although China superseded Japan as the largest natural gas consumer in Asia in 2011, by 2012, Russia was primarily focused on serving Japan, dedicating 0.4 Tcf of natural gas from the country’s first LNG plant Sakhalin II, which is depicted in Figure 1.3 (Torres 2012). Russia’s second LNG plant near Vladivostok, which will have an annual capacity of no less than 0.75 Tcf of LNG, is on its way. Gazprom estimates that the first train will be commissioned in 2018 and the supply of natural gas for liquefaction will be delivered from the nearby gas production centers Yakutia and Irkutsk (Gazprom, Vladivostok-lng).

Demand for natural gas in Japan has had sudden increase recently. This is most likely due to the shutdown of nuclear power plants within the country. However, substantial investments in infrastructure would have to be made if Russia wishes
Figure 1.3: Gazprom’s East coast natural gas projects
to utilize this increase in demand. This is certainly a possibility in the long run. A project that would connect Russia and China with a gas pipeline had been put on hold since the mid 2000s due to unresolved gas pricing disputes. However, this project was restarted in 2013 when the two giants finally resolved their pricing issues. A 30-year annual supply of China of 1.34 Tcf of Russian natural gas has been agreed on and is predicted to commence between 2018 and 2020 (RBC 2013). The head of Gazprom Alexei Miller also mentioned a possible increase of up to 2.12 Tcf for annually supplied gas to China over the new pipeline (RBC 2013).

The Yamal LNG plant, situated in the northeast of the Yamal Peninsula, is scheduled to commence production between 2016 and 2018. However, this will be the first non-Gazprom owned LNG plant built in Russia, since Novatek, Russia’s leading independent natural gas producer, will begin exporting shiploads of LNG from the plant to European and Asian markets (Mamedov, Geydar et al. 2013). Something to keep in mind is the high fixed cost of LNG projects. For example, it is estimated that the Yamal LNG project will cost around $40 - 42 billion, the Vladivostok LNG will cost about $13.5 billion, while the Sakhalin LNG, with a capacity to export 0.5 Tcf of LNG, costs Gazprom $10 billion (Mamedov et al. ).

**Price formation history and current developments**

Historically, natural gas prices have been indexed to oil, even though production costs for these two commodities are different.
Because of this, high oil prices have brought on inflated gas prices. This has suppressed a more rapid adoption of natural gas as a fuel source (Yuen et al. 2012). However, there is no reliable global benchmark, other than oil, needed to underwrite expensive projects. Because oil is traded worldwide, it has price visibility, which plays a very significant role in project decisions that involve billions of dollars in costs.

Two forms of oil indexation have prevailed in the global natural gas trade. The natural gas sent to Europe by pipelines was structured around oil products costs. When this indexation originated, oil was still a significant source of energy in the same sectors as gas. LNG trade, on the other hand, was originally linked to crude oil by Japan, the first major international LNG buyer. (Yuen et al. 2012). Japan had no indigenous crude oil supply and wished to move away from its dependence on oil imports as primary source of energy. Following this realization, the natural gas market began expanding and long-distance transport of natural gas became a promising idea, though still requiring a substantial amount of capital. With this expansion, the “take-or-pay” system, common in North American markets, was implemented by exporters in European nations (Yuen et al. 2012). This system constitutes a minimum annual quantity of gas that must be taken by an importer.

Until recently, oil indexation had been successful, in Europe and Asia, for both the LNG and pipeline natural gas trade. No benchmarks had been used that were based on gas supply, yet price ceilings and floors were applied to the market. However, since 2008, increases in demand have become outweighed by surges in supply, applying pressure on natural gas prices to drop
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(Yuen et al. 2012). The recession in Europe contributed to the limited demand for natural gas and, especially, on pressuring gas prices to drop.

Recently, oil-linked prices in Europe have been experiencing heavy fluctuations, as European gas prices have come under pressure and Gazprom appears to be losing its natural gas monopoly. Although a better alternative to the oil link is not available at the moment, as the LNG market continues to grow, new forms of pricing should arise. Already less then half of Europe’s gas pricing is represented by oil-indexation (Yuen et al. 2012).

2. Gazprom and its role in the Russian energy sector

During the years 1992 and 1993, following the collapse of the Soviet Union, the new Russian Federation demolished various state institutions that previously carried out economic activity in favor of the privatization of companies. These liberal reforms, specifically in the energy sector, were implemented in an attempt to promote a competitive energy market (Ismayilov 2013). A movement to privatize all companies that had been previously attached to various ministries was initiated. Before foreign companies were allowed to participate in the auctions for these newly privatized firms, Russian businessmen were given first bids. Most Russian oil companies had been successfully privatized by the mid-1990s. However, in the case of the natu-
ral gas sector, privatization was not imminent (Ismayilov 2013). Gazprom, a direct heir to the former Soviet Ministry of Gas Industry, had been transformed into a state-corporate enterprise in 1989. Even though Gazprom was the first corporate enterprise in the Soviet Union, the state owned 100% of its shares. This began to change in 1993, however, as the economy experienced a wave of privatization. The company began selling its stock to the public. By 1994, only 40% of Gazprom’s shares remained under government control (Ismayilov 2013).

During the mid-to-late 1990s, following the firm’s partial privatization, Gazprom accounted for about half of the revenues within the Russian energy sector. The firm provided 38% of total state revenues, a substantial amount that includes the production of natural gas and other components surrounding it (Ismayilov, Kamal). Russia’s president at the time, Boris Yeltsin, decided to use government power to promote Gazprom. In 1992, a presidential decree gave a substantial advantage to Gazprom in the form of market manipulation. Gazprom’s position was strengthened as Gazexport, the leading foreign trade company in Russia at the time, along with shares of eleven gas transporting companies and seven production companies were transferred to Gazprom (Ismayilov, Kamal). In the next few years, Gazprom was also granted certain tax exemptions, especially those connected to export licenses. These governmental decisions were not backed up by much research, since the Yeltsin-led government was not able to produce a concrete energy strategy. In addition to a non-existent energy strategy, those years were also marked by a weakness of Russian diplomacy. Political instability, the financial crisis of 1998, and the chaos of pri-
vatization promoted substantial investment in Gazprom. The firm gave hope of restoring Russia’s power on the international arena. A consequence of this interference with Russia’s natural gas market, however, was corruption, as high-ranking officials of Gazprom were granted the power to divert company revenues into their pockets (Ismayilov 2013). Nonetheless, energy wealth would prove to be an essential tool in Russia’s foreign policy and represented the driving force behind the restoration of Russia’s power in the international scene. Nearing the presidential elections of 2000, few candidates understood this as well as Vladimir Putin.

### 2.2 Vladimir Putin’s firm adjustments to Russia’s economy

When Vladimir Putin was elected president in 2000, Russia began utilizing its vast energy wealth as a tool to aid its foreign policy. Prior to his election, Putin had already developed a plan for the reconstruction of the Russian economy. This plan utilizes natural resources as a driving force in the economic and political development of Russia (Ismayilov 2013). However, in order to achieve success, the government had to obtain close to full control over the nation’s natural resource corporations. At the time, Russian oligarchs controlled most of the companies that dealt with natural resources. Their poor management and exclusive focus on making profit drove Putin to promote the acquisition of natural resources by the government. Putin envisioned Russia to have a so-called “National Champion,” a corporation that could rub shoulders with multinationals like
Gazprom and the oil company, Rosneft, were the two perfect contenders to be the next “National Champions”. By 2005, Putin had succeeded in obtaining just over 50% of Gazprom’s total shares and appointed the people close to him as the firm’s new administrators (Ismayilov 2013). The president’s plan was a success, since the Russian economy, mainly driven by natural resource exports, maintained a positive GDP growth rate (Trading Economics 2014). In 2000, as shown in Figure 1.4, GDP growth rate reached a peak of 10% and remained strong, above 6%, for most of the next eight years. The growth continued until the financial crisis of 2008 significantly affected the GDP in the following year. By May 2006, the Financial Times reported that Gazprom had become the third largest corporation through market capitalization, behind Exxon Mobil and General Electric (Financial Times 2006). Gazprom, at this point, had become an international company, which was exactly what Putin wanted. Where Gazprom asserted a strong presence, so did the Russian Federation along with its interests. This led to a decision made by the Russian government in 2006 to give Gazprom an exclusive right to sell and export natural gas abroad (Ismayilov 2012).

Earlier on in the report, Gazprom was referred to as “Russia’s sole natural gas exporter”, as the company had been from 2006 onwards. Since December 2013, however, Russia’s Energy Ministry has been able to grant licenses to export liquefied natural gas. An official LNG export law is expected to come into effect in 2014, according to Bloomberg (Shiryaevkaya 2013). This will provide Russian corporations, such as Novatek and Rosneft, with the opportunity to compete with rising competition in the
world market for natural gas.

Although Vladimir Putin did not intend for Gazprom to become a monopoly, his government’s actions certainly facilitated making this a reality. This corporate giant currently produces nearly 90% of Russia’s natural gas and operates more than 168,000 kilometers (104,000+ miles) of gas pipelines (Ismayilov). Besides Gazprom, there are several independent gas producers like Novatek, as well as some Russian oil producers, such as Rosneft and Lukoil, which are becoming increasingly active in the gas market. Russia’s total capacities for natural gas production in the next ten to fifteen years are projected to rise by 13-15 Tcf (Paltsev 2012). With such projections, we can assume that Gazprom has several market expansion projects lined up. Of that increase in production capacity, annual LNG exports of 2 to 3 Tcf are predicted to be shipped to Asian markets, and will be discussed in greater detail later in the research (Paltsev).

2.3 Russia’s domestic market for natural gas

Measured by its GDP in 2013, Russia is the eighth-largest economy in the world. With a GDP of $2.2 trillion in 2013, Russia is not only the largest producer and exporter of natural gas, but it is also the world’s second largest gas consumer, after the US (BP 2013). Russia’s domestic consumption of natural gas in 2012 was about 14.7 Tcf, compared to the European Union’s consumption of 16.5 Tcf (BP 2013). The harsh winters of Russia necessitates the maintenance of heating and electricity supply in order to ensure the people’s well-being during those months.
Many industries in Russia, especially those that produce electricity, heavily depend on natural gas. About 70% of the total natural gas produced in Russia, 20.9 Tcf in 2012, is sold in the domestic market at prices averaging around $328 for every thousand cubic feet of gas (EurActiv 2012). However, as the natural gas price in the international market is indexed to oil trade, in 2011, Gazprom was able to sell around 5.5 Tcf at an average price of about $1105 for every thousand cubic feet of gas (Shiryaevksaya 2013).

3. Key Factors to determine future demand for Russian natural gas

3.1 Key developments that created changes in European energy policy

Ensuring energy security has always been a major priority for all European nations. Russia, being Europe’s most important natural gas exporter, has dedicated a great amount of resources to ensure a secure supply of gas to its customers. The gas crises of 2006 and 2009 showed Gazprom’s flaws in the securing a consistent gas supply for the EU. Since then, the corporation has invested substantially in the diversification of transportation routes to Europe, as in the examples of Nord Stream and South Stream. These crises, however, also revealed the fact that Europe greatly depends on Russian gas.

In 2006, several European nations experienced shortages in the supply of Russian natural gas (Ismayilov 2013). This was a
period of three days during which Russian gas exports were cut off to Ukraine as a result of a pricing dispute. A very similar, but more severe, gas crisis occurred in 2009, when Russia stopped all gas supplies to Ukraine due to the failure to agree on prices of supply and transit. All Russian gas supplies to the EU were ultimately disrupted. No shipments of natural gas were delivered for another fourteen days (Ismayilov). Economic problems and the winter weather posed serious problems for many European nations during this period of insufficient gas supplies. These two crises did, however, provide incentives for new natural gas projects between the European Union and the Russian Federation. Another significant change in European energy policy has been a recent movement away from nuclear energy in several EU nations, such as Germany’s decision in the wake of the Fukushima nuclear disaster in Japan to move to shut down all nuclear reactors in the country (Breidthardt 2011).

3.2 Significant factors that may influence supply and demand for Russian gas

Recent developments in the world natural gas market underline certain possible changes in the supply and demand of gas. Both Russia and Gazprom will certainly be affected by any fluctuations in the gas market, as the firm continues to increase its export capacity of both dry natural gas and LNG. Here are a few significant events and findings:

- One of the United Kingdom’s main energy providers recently signed a deal with the United States’ Centrica to
import 1.75 million metric tons of LNG annually for 20 years with an expected start date in 2018 (Werber, Lefebvre 2013). The US is currently expanding its LNG export capacity through the initiation of new plant projects. The United States’ benchmark natural gas prices have stayed below $4 per million BTU (Werber, Lefebvre 2013). This is mainly due to the fact that the pricing scheme of natural gas in the US is managed by the Henry Hub, the main distribution hub of the United States. The potential of increasing US exports of LNG in the future could fulfill the extra demand in Asian markets, as well as expand the LNG trade beyond the UK to other European nations. In both of these cases, Russia would have to go up against the US as a gas export competitor.

- Putin has been pushing toward a more liberalized Russian natural gas export market by enabling Russia’s Energy Ministry to grant licenses to export LNG (Mamedov et al. 2013). With this new and official license, the previously mentioned corporation, Novatek, will be able to export LNG from the Yamal LNG plant, which is currently being constructed. This is a big step for Russia’s natural gas industry.

- Cost inflation and delays seem to have resulted in depleted returns for LNG. The cost of constructing new LNG plants has been rising steadily, which can be attributed to several factors: the complexity of new LNG projects, site preparation costs have increased, LNG tanks are getting more expensive, and the costs associated with skilled labor have
increased (Dart, Currie, Spetz 2013). Although there will be a certain increase in future demand for LNG in the world natural gas market, the marginal cost of liquefied natural gas production and export will also rise in concert with the demand. Russia’s share in the world LNG exports will continue to rise as new projects are completed, but cost inflation should also be kept in mind as the market progresses.
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Chapter 2

The Brick-and-Mortar Conundrum: Conduct and Competition in Book Sales
Aaron Goslee, University of Massachusetts Amherst

Introduction

This essay focuses on local independent brick-and-mortar retail stores selling for-pleasure books. An assumption is made that one does not find a level of cross-elasticities of demand between books and textbooks or magazines that would substantiate their inclusion in the following analysis. The excluded items could be included in a discussion of product proliferation under the greater product market of “reading materials” (Waldman & Jensen, p. 395). This exclusion still leaves a vast array of products within the market. Using the New York Times Best

1agoslee@umass.edu
Sellers list, one finds fifteen distinct categories.²

Surveys of individuals who have lived or purchased a book in Amherst show Amazon and Amherst Books to be the most patronized book-selling establishments. Using this as a starting point, it is necessary to include Food For Thought Books, an establishment located just around the corner from Amherst Books, and Barnes & Noble, the well-known book-selling megalith located in a shopping plaza two miles from the center of town. (To be specific, this essay will focus on establishments that are patronized by the citizens of Amherst and fall into the NAICS categories of 451211, 553310, and 454111 to the extent that they compete with Amherst Books of Amherst, Massachusetts.)

Meet The Producers: The Role of Publishers

Booksellers are subject to a wholesale model. Publishers are responsible for the production of the book in its final form. They then sell the book to a bookseller for a wholesale price, which can be thought of as a discounted rate off of the suggested retail price (SRP). Each bookseller has their own relationship with the publisher, and it is up to the booksellers to negotiate with the publisher in deciding the wholesale price. Bookstores and

²These include (print:) hardcover fiction, hardcover nonfiction, paperback trade fiction, paperback mass-market fiction, paperback nonfiction, advice how-to and miscellaneous, children’s picture books, children’s middle grade, children’s young adult, children’s series, hardcover graphic books, paperback graphic books, manga, (e-books:) fiction, and nonfiction. This essay will exclude all children’s and manga publications from its discussion as they are not focused substitutes to the extent demanded for this analysis.
publishers set prices per book, as opposed to per order. The bookseller then decides the cost for the consumer. The standard wholesale rate is 40%. However, there are often larger discount rates when working directly with smaller publishers. The bookstores are free to sell the book at any price, which may include prices less than wholesale price or greater than the SRP. It is important to note that unsold stock can be returned to the publishers, although booksellers must pay for shipping in the event that they return part of the stock (Blechman, 2013). This allows the purchasing of individual books to be nearly risk-free for the booksellers. The existence of competitive publishers and competitive intermediaries theoretically reduces the cost of a book for a buyer and makes the market more efficient (Spencer, 2012).

The Bane of Brick-and-Mortar Existence: Volume

One of the primary ways for booksellers to realize economies of scale in the book market is by selling large volumes. This allows them to leverage their large volume of sales when negotiating the wholesale price with publishers. Amazon and Barnes & Noble have a clear advantage here, as their sales rates are exponentially greater than the smaller, local bookstores. Sandy Lillydahl, Maps librarian at the W.E.B. Du Bois Library in Amherst, Massachusetts, reports that Amazon “has the power to demand free shipping from publishers.” This adds to their economic advantage.

Another way to realize economies of scale is by keeping com-
pany space and employees engaged in labor when they are not selling books. The only establishment that has the ability to engage in this activity is Amazon. Their books are located in large warehouses that also contain other inventories. When orders are not coming in for books, employees can fill orders for other products. This offers Amazon a large advantage in comparison to other booksellers (Waldman & Jensen, p. 41). Barnes & Noble is also able to achieve these economies of scope to a lesser extent – by selling other forms of media, such as a vast array of DVDs and CDs, they can shift labor to these other items.

The Situation: Pricing Strategies For A Dominant Firm

As Amazon is able to utilize these economies of scale to lower prices to a level that other firms are unable to reach, this market can be contextualized in terms of a dominant declining firm pricing model.
Take Figure 1 as a theoretical template to use in consideration of the pricing behavior of booksellers. The aforementioned economies of scale and scope give Amazon a significant cost advantage compared to its rivals (Waldman & Jensen, p. 139). This translates into a lower marginal cost for the “dominant firm” at every level of supply. At certain prices, however, the fringe suppliers will be able to provide the market with some supply. Waldman and Jensen (2013) discuss the implications of this for the market:

“...The dominant firm’s market share declines continuously over time... If the competitive fringe firms earn above-normal economic profits, there will be an
incentive for the fringe supply to increase over time as new firms enter and existing fringe firms expand output. As a result, the residual demand for the dominant firm will shift to the left (decrease), and the dominant firm’s relative share of output will decline.” (p. 141)

One of the great benefits to society is that fringe suppliers will enter the market, innovate, and capture more of the market from the dominant firm when there are positive economic profits. However, this ideal is not what is currently happening in the book market. There are two major implications that one can derive from this dominant-firm price leadership model for the pricing behavior of Amazon and the product selection of local booksellers, and this will assist in finding out what is really happening in the market.

Taking Amazon as the dominant firm, the short-run profit\textsuperscript{3} maximizing price level for Amazon would be the intersecting point of the dominant firm’s MC and MR pushed vertically until it reaches the Residual Demand (PL-PM). This price would be $10, which would allow the fringe market to supply around a fifth of industry demand. However, with a dominant firm looking to expand their share of the market, they would not adopt such a short-run approach. This approach would result in a declining share of the market over time. What is important in this model is that the dominant firm can reduce the price of the

\textsuperscript{3}As this is an economic analysis, profit should be assumed to mean economic profit. Any mention of accounting profit will be specifically stated as such.
book while still making a positive profit and reducing the market share of the fringe suppliers. This price can be decreased until profit disappears, which is where MC intersects with Residual Demand (PL-MM). This means that Amazon has the freedom to manipulate price in the range $6 < P \leq $10 to minimize fringe supply while still making positive profits. Most problematic for the fringe firms is that, if we take this graph as reflective of actually existing markets, there are prices at which Amazon will be able to make a profit while pricing out its competition. For example, according to the model described in Figure 1, Amazon would have the ability to satisfy industry demand at $7, while making a positive profit of $78.40. If we multiply the quantities by thousands, we’d get a more accurate view of the real positive profit Amazon can make while pricing out its competition.

It is notable that Amazon has not stopped at this limit price of PL-MM. This would be highlighted most poignantly in discussion of the lawsuit the Department of Justice brought against Apple and five major publishing companies in April of 2012. Auletta (2012), in a report on the lawsuit, claims, “In the effort to gain even greater market share, [Amazon] was selling books at a loss; while publishers typically sold e-books to Amazon for about fifteen dollars apiece, Amazon was selling many of them for $9.99.” This aggressive strategy parallels predatory pricing, and provides clear evidence of Amazon’s intent to gain firm con-

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4This would indicate that Amazon does not have as significant of an advantage over the fringe suppliers as shown in Figure 1 (thus moving the MC inward or increasing slope) or that they are acting more aggressively to establish their reputation within the industry (Waldman & Jensen, p. 356).
trol over the bookselling industry.

The Art of War: Is the Sun Setting on Brick-and-Mortar Book Retailers?

The preceding analysis perhaps implies that Amazon will consistently outcompete the fringe firms in the long run, becoming a monopolist power in the bookselling market. Perhaps if Amazon makes a high profit in their book selling, one will see competitive entry that mirrors or enhances their business model. However, in the analysis of the local book market, the question is whether Amazon’s pricing strategies will cause local brick-and-mortar stores to eventually go out of business. There are several ways brick-and-mortars use their comparative advantages to maintain business, offering potential for long-run sustainability.

The first manner in which local bookstores are able to maintain position in the market is when the dominant firm’s marginal cost lays closer to the fringe supply line. Consider general purchasing behavior. There are products that become highly popular, and demand shifts outward. This can be typified in the New York Times Bestseller list, to which many people refer when looking for a book to purchase. The bandwagon effect may come into play here, as more people are willing to pay higher prices to read a new, popular book. Recent examples include the Fifty Shades of Grey series, the Harry Potter series, and the Hunger Games series. For these books, Amazon has a great advantage: it can use its economies to offer lower prices and bring a larger
2.0. **TOTAL PRICE WAR**

customer base into the fold. Local brick-and-mortars cannot hope to compete in the sales of these books. However, there are many books that remain in relative obscurity or in small, niche markets. It is here where Amazon loses its edge, allowing local bookstores to increase their supply.

Julie Bosmon writes, in a January 28, 2012, *New York Times* article entitled “The Bookstore’s Last Stand,” “What publishers count on from bookstores is the browsing effect. Surveys indicate that only a third of the people who step into a bookstore and walk out with a book actually arrived with the specific desire to buy one.” Compound this with what Barry Schwartz calls “the paradox of choice” and one finds an area where local bookstores have an advantage. A 2012 article in *The Economist* entitled “The tyranny of choice: You choose” provides data that shows “As options multiply, there may be a point at which the effort required to obtain enough information to be able to distinguish sensibly between alternatives outweighs the benefit to the consumer of the extra choice.” Local bookstores have an advantage in this regard, as they have private space to hold events that lure in potential customers. These people are then within the store, and they face comparatively fewer options as they browse. This leaves Barnes & Noble’s brick and mortar stores in a very precarious situation, with their massive stocks potentially overwhelming browsers and leading to lower sales, while still potentially disappointing any particularly choosy consumers if a particular obscure book is not in stock.

Table 2.1 shows the price point at Amherst area bookstores of seven in-stock books with a range of popularity. Looking at this data leads to a general conclusion that Amherst Books
and Food For Thought price nearly the same, or that they rarely stray from SRP. This is followed by Amazon’s and Barnes & Noble’s physical books, which are priced at an average of 71.55% of SRP. The cheapest are e-books on the Nook and Kindle, which are priced at an average of 58.89% of SRP. Some telling indicators are 1) neither the Nook nor Kindle carried the least popular book, 2) the Kindle was the cheapest bundle, although just barely, and 3) there was a general decline in the difference between the SRP and all of Barnes & Noble’s and Amazon’s options as sales faded. These results are all consistent with our previous theories. However, a linear regression pricing model suggests that the coefficient of determination between popularity and the markup (difference between pricing and SRP) never exceeds 0.24. The relationship, if it exists, is either smaller than imagined or cannot be derived from such few data.

All prices were gathered on May 6th, 2013. The books are ordered in descending sales based on Amazon’s Best Sellers Rank. They were, in order from top to bottom, ranked 13, 151, 97909, 135761, 869785, and 1177463 in Books.

In order to see if there is a direct relationship between price and popularity, turn to Table 2.2. Using greater amounts of pricing information, there appears to be a more dramatic and obvious relationship between popularity and difference between price and SRP. The greatest difference between selling price and SRP was seen for books on the New York Times Best Sellers list. This reaches a minimum of 41.05% of SRP by the Kindle. These results also confirm that Amazon’s pricing approach is aggressive, as Amazon’s options are priced lower than Barnes and Noble’s in five out of six comparisons. The one area where
Table 2.1: Prices for a Selection of Books in the Amherst Area Market

<table>
<thead>
<tr>
<th>Title/Store (Format)</th>
<th>Amherst Books</th>
<th>Food For Thought Books</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sedaris, <em>Let’s Explore Diabetes with Owls</em></td>
<td>$27.00</td>
<td>$27.00</td>
</tr>
<tr>
<td>Butler, <em>Parting Ways</em></td>
<td>$27.95</td>
<td>$27.95</td>
</tr>
<tr>
<td>Burroughs, <em>You Better Not Cry</em></td>
<td>$14.00</td>
<td>$7.00</td>
</tr>
<tr>
<td>Miller, <em>On Being Different</em></td>
<td>$13.00</td>
<td>$13.00</td>
</tr>
<tr>
<td>Wilde, <em>I’ll Take What She Has</em></td>
<td>$15.00</td>
<td>$15.00</td>
</tr>
<tr>
<td>Olstein, <em>Little Stranger</em></td>
<td>$16.00</td>
<td>$16.00</td>
</tr>
<tr>
<td>Total</td>
<td>$121.94</td>
<td>$114.94</td>
</tr>
<tr>
<td>% SRP</td>
<td>100</td>
<td>94.26</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Title/Store (Format)</th>
<th>Barnes &amp; Noble</th>
<th>Nook</th>
<th>Amazon</th>
<th>Kindle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collins</td>
<td>$7.49</td>
<td>$6.50</td>
<td>$6.64</td>
<td>$5.00</td>
</tr>
<tr>
<td>Butler</td>
<td>$18.51</td>
<td>$14.84</td>
<td>$18.51</td>
<td>$14.84</td>
</tr>
<tr>
<td>Olstein</td>
<td>$9.67</td>
<td>-</td>
<td>$12.48</td>
<td>-</td>
</tr>
<tr>
<td>Total</td>
<td>$85.78</td>
<td>$72.68</td>
<td>$88.70</td>
<td>$70.93</td>
</tr>
<tr>
<td>% SRP</td>
<td>70.35</td>
<td>59.60</td>
<td>72.74</td>
<td>58.17</td>
</tr>
</tbody>
</table>

All prices were gathered on May 6th, 2013. The books are ordered in descending sales based on Amazon’s Best Sellers Rank. They were, in order from top to bottom, ranked 13, 151, 97909, 135761, 869785, and 1177463 in Books.
Table 2.2: Large Seller Prices for Selections of Books as Percentage of Suggested Retail Price, by Format

<table>
<thead>
<tr>
<th></th>
<th>SRP</th>
<th>B&amp;N</th>
<th>Nook</th>
<th>Amazon</th>
<th>Kindle</th>
</tr>
</thead>
<tbody>
<tr>
<td>7 Titles Shown</td>
<td>$121.94</td>
<td>$85.78</td>
<td>$72.68*</td>
<td>$88.70</td>
<td>$70.93*</td>
</tr>
<tr>
<td>in Table 2.1</td>
<td>-</td>
<td>70.35%</td>
<td>59.6%</td>
<td>72.74%</td>
<td>58.17%</td>
</tr>
<tr>
<td>Amazon</td>
<td>$134.80</td>
<td>$86.62</td>
<td>$76.36</td>
<td>$77.80</td>
<td>$55.37</td>
</tr>
<tr>
<td>7 Top Seller Books</td>
<td>-</td>
<td>64.26%</td>
<td>56.62%</td>
<td>57.72%</td>
<td>41.08%</td>
</tr>
<tr>
<td>NYT</td>
<td>$151.87</td>
<td>$89.26</td>
<td>$68.65</td>
<td>$83.95</td>
<td>$62.34</td>
</tr>
<tr>
<td>6 Best Selling</td>
<td>-</td>
<td>58.77%</td>
<td>45.2%</td>
<td>55.23%</td>
<td>41.05%</td>
</tr>
</tbody>
</table>

The Amazon 7 Top Seller Books takes Amazon’s Best Sellers Rank in Books on May 6, 2013. NYT 6 Best Selling takes the three most popular combined hardcover and paperback fiction and three most popular combined hardcover and paperback nonfiction from the New York Times Best Sellers list for the week of May 12, 2013. All prices are set as of May 6, 2013. *As one of the selected titles did not have a Nook or Kindle edition, the average cost of the other six titles was taken and added into their total cost.

Amazon does not price cheaper than Barnes & Noble is for the physical titles shown in Table 2.1. Here the difference is only 3.34% using midpoint formula \((72.74-70.35)/(72.74+70.35)/2\). However, this may be significant for pricing strategy.

There are two notable conclusions when the two most popular titles are removed from Table 2.1. First, the difference between the selling price and the SRP for each possible book form from each possible location shrinks. Secondly, Amazon’s price for these physical books, which are the five lowest selling books
presented, exceeds Barnes & Noble’s by 9.53% using a midpoint formula \((78.61-71.46)/((78.61+71.46)/2)\). Since the seven titles used here were those found in conspicuous locations in Amherst Books and Food For Thought Books, this trend may perhaps increase when a new selection of less commonly desired books is used. The implications here are that 1) the prices merge towards SRP as the turnover of the title decreases and that 2) Barnes & Noble maintains the most competitive pricing on titles that are or have become obscure.

**How To Deal With Never Being Good Enough: Prisoner’s Dilemma and Conscious Parallelism**

As Barnes & Noble only has a price advantage on Amazon when it comes to books with lower rates of sale, and Amherst Books and Food For Thought Books never have a price advantage, how do these smaller brick-and-mortar book retailers remain economically feasible?

There does seem to be a strong desire by the local stores to utilize the benefits of the browsing effect by holding events that will hopefully lure customers into the store and translate into sales. Amherst Books’ calendar of events on its website shows nine events during May of 2013. Food For Thought Books’ calendar of events shows an average of twelve events each month between January and April of 2013. Barnes & Noble has a cafe within its walls selling Starbucks coffee.
The stores also utilize sales. These are strategically placed in the front of the store and in areas towards the front of the store, often directly next to the newest books that are priced at SRP. These books, at both Amherst Books and Food For Thought Books, are purchased separately from distributors who purchase returned stock from the publishers for greatly reduced rates. These are termed “remainders” (Blechman, 2013). Amherst Books’ primary remainder distributors are Daedalus and “Texas Bateman”\(^5\) (Scott, 2013). Barnes & Noble also has sale prices towards the front of the store. These have a sticker that says “Bargain Priced Books” and reports the price. A quick Internet search reveals that these are books that are printed by Barnes & Noble’s own publishing house. The primary role of sale placement is again to lure customers into the store, with the hope of exposing them to the browsing effect.

Amherst Books has a large collection of used books and also sells textbooks assigned by local college professors. Food For Thought Books is considering expanding into the used books market, but discontinued textbook sales after the Spring 2013 school year as they did so at a loss for several seasons (Blechman, 2013). All three stores have children’s sections and magazine racks. Barnes & Noble has an extensive multimedia collection.

Framing this economically, the question arises why all of the stores seem to engage in the same behaviors. Offering sale books at each store in the same location does not necessarily excite and entice the customer; they will receive sales at ev-

\(^5\)An online search did not reveal a company by this name, and as the spelling was not confirmed with the interview subject, it may be incorrect.
2.0. **DILEMMA**

<table>
<thead>
<tr>
<th>Payoff (A,B)</th>
<th>Store B: Few Events, Only New Books</th>
<th>Store B: Many Events, Other Items</th>
</tr>
</thead>
<tbody>
<tr>
<td>Store A: Few Events, Only New Books</td>
<td>(100, 75)</td>
<td>(90, 90)</td>
</tr>
<tr>
<td>Store A: Many Events, Other Items</td>
<td>(110, 65)</td>
<td>(95, 70)</td>
</tr>
</tbody>
</table>

ey store and perhaps better ones on Amazon. The stores face large competition for textbooks, as there are a myriad of online sources, as well as the ability for the consumer to rent them. Holding events often demands additional expenditures on labor and variable costs. A simple prisoner’s dilemma model provides a suitable explanation.

Here we find Nash equilibrium in the bottom right cell. Even though these events and extra items may not increase profit, it is the dominant strategy to add more to the store than just new for-pleasure books. The reality of the booksellers following their dominant strategy is shown in broadening conduct to sales, used, events, etc.

Finally, the decision by the smaller local bookstores to maintain SRP is found to be conscious parallelism. Both stores know that they cannot compete with Amazon and Barnes & Noble in pricing strategy. If they were to begin lowering their prices away from SRP to compete with each other, the stores would quickly become unsustainable. The stores instead fo-
cus on events, non-new book items and product differentiation that caters to a niche audience. These strategies allow Amherst Books and Food For Thought Books to utilize their comparative advantages and essentially work in combination against the other two booksellers.

Additional Comments

This essay barely scratches the surface of the potential research that could be done on the local book market. The market is going through an exciting transition, with constant change and strong competition in the digital area. During the writing of this analysis, Barnes & Noble announced that its Nook would now pair with Google to offer an array of products in the Google Play store. This development perhaps provide hints that Barnes & Noble has their eyes set firmly on digital innovation, indicating where they hope to contend in the future of the industry.

For later research, the author of this essay would like to find the true cross-elasticities of demand for textbooks and other reading materials not included. This could greatly influence the outcome of results and allow discussion more truly indicative of bookselling behavior. A full array of wholesale prices, especially from Amazon and Barnes & Noble would help solidify the theories set forth in this essay. However, the author feels relatively confident in the findings of his analysis without them. That Food For Thought Books is a not-for-profit collective model was not considered in the confines of this essay, and will need to be considered in greater depth.
There is an issue with more accurately defining the market in the future. A consideration of the interaction between the four booksellers relevant to this essay and other booksellers with either an online presence or those that remain at the fringes of the brick-and-mortar market would also be appropriate. The question of compatibility in complements when dealing with Nooks and Kindles, along with the investment cost of purchasing one and the lock-in effect of owning one, was not covered. A greater understanding of the evolution of the book market would be of interest.

Note: In June of 2014, during the publication process of the journal, Food for Thought Books closed, with members of the independent, not-for-profit collective citing financial difficulties. The increasing tendency of college students to buy textbooks online – especially in international editions, which are not distributed to brick-and-mortar stores in the US but are sold for considerably less than domestic editions online – appears to have hurt Food for Thought quite a bit. The organization served Amherst for nearly four decades, and will be missed by a community of scholars and readers which now features only one small bookseller. -AM

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6The author intended to include a section called “Nooks and Grannies: Compatibility Check on BN.com” and highly regrets its exclusion
Bibliography


Chapter 3

The Effects of Latino Immigration on the United States During the Global Recession of 2008

Ethan Schein, University of Massachusetts Boston

Introduction

The United States’ late-2000 housing bubble crash and subsequent recession triggered a catastrophic current of heightened unemployment and decreased GDP that not only crippled the US economy, but negatively impacted the global economy as well. With lower demand for goods and services, firms saw an incentive to lay off workers, or (in the best case scenario) decrease wages. It is speculated that in a depressed economy the foreign-born bear the brunt of the downturn. This paper

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1Ethan.Schein001@umb.edu
addresses the question of whether a specific foreign-born population, in this case immigrant Latinos, bore, in proportion, a significantly larger drop in median income and rise in unemployment during the previous recession than the native-born population. It is hypothesized that the Latino immigrant population was affected more negatively in both categories. The paper uses 2000 US Census data to examine the relationship between unemployment and median income before the recession and compare the native-born versus Hispanic-born populations. Then the paper uses 2010 ACS data to examine the change that may have occurred.

**Immigration and the Global Recession**

Many believe that the worst of the US recession is over, but it is clear that the labor market continues to be extremely depressed. Unemployment has been at its highest levels in two decades, with close to 4 million jobs being lost between January of 2009 and January of 2010 (Peri, 2010). During times of economic hardships the topic of immigration becomes center stage for debate, while policy makers feel an ongoing pressure to address the topic. During a depressed economy there is some truth to the notion that immigration hinders native employment and native median income in the short run. Conversely, in the short run in a growing economy immigration has little effect on employment, but increases productivity, which leads to an increase in median income for the native-born and foreign born population alike. In the long run, immigration has an unequivocal
positive effect on employment, productivity, and income (Peri, 2010). It is just during the short run that adjustments need to be made. It is hypothesized that the 2008 Global Recession disproportionately affected Latinos in the United States, leading to an increased amount of unemployment and a decreased level of median income compared to the native-born population.

The Great Recession has caused a decrease in the number of Mexican migrants who otherwise would have come to the major immigrant-receiving nations in the world (Fix et al., 2009). From 2006 to 2009 immigrants leaving Mexico in order to migrate to the United States decreased from 1 million to 600,000, mostly due to a drop in unauthorized immigration to the US. Although the recession obstructed illegal immigration flows from Mexico to the United States, legal Mexican migration saw its levels relatively unaltered. As a result, Mexican migration to the US, which was expected to grow by 1 million, remained unchanged. The majority of Mexican immigrants already in the US have remained stationary. It seems that they would rather stay in the United States than returning to their country of origin despite relatively high unemployment in the US, suggesting that there may be an increase in migrants who entered the informal labor market. Flows from the United States back to Mexico saw virtually no change even though Mexican and Central American immigrants living in the United States had unemployment rates nearly double (Fix et al., 2009). This leads credence to the proposition that people’s decisions to migrate back to their country of origin are dependent to an even larger degree on how well the immigrant-sending country’s economy is performing.

Contrarily to the United States’ experience, a large number
of recent immigrants in the UK and Ireland went back to their country of origin after the recession. Out of 1.4 million immigrant workers who came to the UK between May 2004 and May 2009, half of them returned by the end of 2008 (Fix et al., 2009). While the Irish and British economies were contracting, some economies of Eastern Europe, especially Poland, were seen to have an abundance of opportunity. The number of immigrants returning to their country of origin may also be attributed to the ease of circulation between countries in the European Union.

Spain also saw its migrant population decrease after the recession. Prior to the recession, Spain realized a sevenfold increase in migrants among the total population, but by 2008 there was a decline of a quarter of the immigration inflows from Eastern Europe (Fix et al., 2009). For instance, Bulgarian and Romanian immigration to Spain decreased by nearly 60%. It is estimated that the total number of immigrants who left Spain after the recession nearly doubled, from 120,000 leaving to 232,000 leaving in 2008. However, the amount of immigrants departing from Spain may be a testament to Spain’s unemployment rate of over 20%. Migrants from Latino and African countries have for the most part stayed static due to the even worse economies of their countries of origin (Fix et al., 2009).

Neoclassical economics may help explain why migrants decide to either reside in the immigrant-receiving country or return back to their country of origin. The traditional theory suggests that immigration is fundamentally tied to international wage differentials (Massey, 1994). If the expected income (which is the probability of employment times the average income in the economic sector) is higher at the destination country than in
the home country, migration should flow in the same direction. While labor moves from the low wage countries to the high wage countries, we see capital moving in the opposite direction. This flow of migration continues until the wage gap equals the cost of migration, at which point there is no net benefit to migration. A 1963 study by Fleisher (cited in Massey) evaluated net migration through the lens of the unemployment ratio. Fleisher’s findings saw a strong correlation between Puerto Rican unemployment and an increase in migration volume. The higher the unemployment rate was in Puerto Rico, the more people migrated to the United States. Airfare also played a key role, with an increase in travel costs reducing the amount of migration to the United States. Maldonado, using data that spanned from 1947 to 1973, updated Fleisher’s findings in 1976. Using a much more in depth model, Maldonado confirmed that as the amount of unemployment in Puerto Rico grew in relation to US unemployment, out-migration increased. Her findings also showed that wage differentials played a pivotal role in migration. As the average wage in Puerto Rico rose against wages in the United States, the amount of migration fell (Massey, 1994).

Migration is not always entirely an individual’s decision. Confronted with one of the worst global meltdowns in recent history, some governments around the world have decided to change their immigration policy in order to reduce the flow of immigration; some have encouraged recent immigrants to leave while attempting to protect the labor market for the native-born population (Fix et al., 2009). Countries such as Thailand, Kazakhstan, Malaysia, Russia, and Australia decreased the number of work permits that were issued while the United Kingdom
tightened up its admission requirements for a visa. Canada decided not to tamper with the amount of visas issued, and as a result it found that employer demand for temporary workers increased. The province Alberta saw an increase in demand for temporary workers rise by 340% from 2004 to 2008. The demand was so great that Alberta enacted a program to retrieve temporary workers from the United States, granting them an accelerated Canadian citizenship for temporary work (Fix et al., 2009).

Adjusting visa permits was just a single way that countries responded to unwanted immigration. France decided to double down on their efforts to deport illegal immigrants at work sites, conducting random raids that resulted in a mass deportation (Fix et al., 2009). Some countries such as Japan, Czech Republic, and Spain decided to employ a “pay-to-leave” program that paid for an immigrant’s one-way ticket back to their country of origin, along with a lump sum of money that generally mirrored what one would get for unemployment insurance benefits. The United Kingdom enacted a similar program, but it was offering assistance before an immigrant would illegally migrate to the UK at the Channel of Calais, France. Immigrants waiting to be smuggled into the UK were offered a plane ride to their origin country and 2,000 Euros in cash if they would take the deal (Fix et al., 2009).

Mexicans in the United States represent the largest foreign-born population in the country. In 1990, Mexicans represented 6% of the total US population (Massey, 1994). This can partially be explained by the extreme average wage rate differential between Mexico and the United States. The average wage rate
between the two countries differs by a factor of five, and even after transportation costs, the cost of housing, and other miscellaneous expenses Mexican migrants can expect to earn up to three times as much living in the United States (Massey, 1994). With the average wage rate having such a wide gap, it is clear that any downturn in the economy would have to be even worse in the immigrant-sending country in order for immigration flows to be halted or even reversed. If the individual calculates that a migration to the origin country will not end up in a positive net monetary return, then migration may be deterred (Massey, 1993). Wage differentials may not be the only factor on a Mexican’s decision to migrate to the US. Although wage differentials are extreme, other factors such as Mexico’s crushing economic crisis of the 1980s, the proximity of the US to Mexico, or the population explosion in Mexico in the later half of the 20th century can also be seen as an influencing factor of Mexican migration to the US.

Periods of economic downturns in the US have historically affected recent immigrants, native-born Latinos, and African Americans disproportionately (Paral, 2009). In 2008, the average unemployment rate for native-born Latinos was 8.4.

In most countries it was the immigrant population that was struck the hardest by the Global Recession. These include the Latino population in the United States, and all foreign nationalities in Spain and Portugal (Fix et al., 2009). However, the trend of high unemployment for a country’s immigrant population does not extend worldwide. For example, in many European countries the foreign-born unemployment rate didn’t increase between 2006 and 2008. Many European countries also saw de-
CHAPTER 3. SCHEIN – LATIN@ IMMIGRATION

Increases in the gap in unemployment rates between foreign-born and native-born populations from the first semester of 2007 to the first semester of 2009 (Fix et al., 2009). The major migrant-sending countries, such as Mexico, have seen increases in unemployment, but greater increases in underemployment. However the trend is undeniable; immigrants were far more likely to be poor or worse off than the native-born population worldwide.

In most cases, the foreign-born are the first to be fired and sustain a higher unemployment rate throughout the duration of a recession (Fix et al., 2009). This is because a high concentration of immigrants are condensed in only a few sectors such as construction, wholesale, hospitality, and export-focused manufacturing. The aforementioned sectors are extremely sensitive to business-cycle fluctuations and sustain immediate damages at the onset of a recession. Immigrants that are employed are usually involved in a less secure form of employment. For instance, they may partake in illegal employment, temporary work, or seasonal jobs. Discrimination may also exacerbate the foreign-born unemployment rate. Studies in the United States, Canada, and sections of Europe have indicated that job applicants with a foreign (or “ethnic”) name were less likely to be interviewed for a job than presumably native-born applicants with similar work experience and human capital (Fix et al., 2009).

The effects of the recession on immigration streams are complex and have proved difficult to measure. This is because there is such a vast amount of immigration avenues and profiles of migrants, often only broadly classified as international students, temporary workers, permanent workers, or illegal immigrants. However, data across migration streams have led to one simi-
lar conclusion: it is apparent that there is a lack of evidence that supports the theory that the recession has lead to migrants returning to their country of origin post-recession. It can be concluded that return migration isn’t solely decided based on job prospects in the destination country (Fix et al., 2009).

The recession of 2007-2008 is global; it is not confined to a certain region or continent like the Asian crisis of 1997-1998. When the whole world is experiencing an economic meltdown, it is very hard to relocate in order to find better working opportunities because they simply do not exist. Other minor factors contribute to the unwillingness for a migrant to return to his or her country of origin. For instance, in hard times a migrant may be able to tap into the social capital provided by a local network, rather than having to go back to their destination country (Massey, 1994) Border enforcement may also contribute to the unwillingness to return, especially if the migrant is an illegal immigrant. Border controls can make migration costly as well as risky; many illegal immigrants refuse to cross the border because they think they won’t be able to cross back in once employment prospects open up (Fix et al., 2009). Return migration is influenced by complex interactions between social, economic, and political relations. It makes little sense for migrants to return to their country of origin when employment prospects look even worse at home.
Data and Methods

The data used for this research are from the United States 2000 Census (collected on April 1st, 2000) and the 2010 American Community Survey (hereafter ACS; data collected throughout 2010). US Census reports encompass analytical data about households, population changes, race, age, family structure, housing, apportionment, and more. The Census is conducted every ten years, collecting economic and household data from counties that are then aggregated into metropolitan areas. This research utilizes data from 20 counties, which are aggregated into 3 metropolitan statistical areas: Boston, Chicago, and Los Angeles. Two different forms were used to collect 2000 census data. The “short form” questionnaire includes questions that are asked of all residents in the households. These questions include age, sex, race, Hispanic origin, tenure, and vacancy characteristics. Some 16% of the population receives the “long form”, including additional questions focusing on social characteristics (such as English language proficiency and education), economic characteristics (such as labor force participation and occupation), and housing items. This research also uses 2010 ACS data, which are collected annually, and are conducted by randomly sampling addresses in every state, the District of Columbia, and Puerto Rico. The ACS investigates age, sex, race, occupation, education, health insurance, veteran insurance, and more.

To test my hypothesis that Hispanic migrants experienced a higher level of unemployment and a decreased median income than the native-born population after the global recession of 2008, I will derive my data from the three different metropolitan
areas which were chosen due to their differences in racial composition, geography, immigration status of the population, housing costs, and economic base industries. For example, the Boston metropolitan area (Boston-Worcester-Lawrence, MA-NH-ME-CT) has a concentration of biotechnological industry, while the Chicago metropolitan area (Chicago-Gary-Kenosha, IL-IN-WI) has a heavy concentration of manufacturing, printing, and publishing industries. Los Angeles (represented here by metropolitan statistical area Los Angeles-Riverside-Orange County, CA) is the largest retail market in the US, and it also sports an economy that is heavily focused on business and trade. I compare four estimates of demographic statistics — percentage Hispanic, percentage native-born, median income, and unemployment rate — for each of the three labor markets.
Results

The unemployment rate percentage grows when more people are without work and are actively seeking work. The independent variables are the native-born and Latino populations in the three metropolitan statistical areas of Boston-Worcester-Lawrence, MA-NH-ME-CT, Chicago-Gary-Kenosha, IL-IN-WI, and Los Angeles-Riverside-Orange County, CA. The native-born in Boston experienced the lowest amount of unemployment at 2.9%, followed by the native-born of Chicago who had an unemployment rate of 4.5%. The Latino population of Boston experienced the highest unemployment rate at 9.48%, closely followed by the Latino population of Los Angeles who had an unemployment rate of 9.3%. In 2000, the unemployment rate was notably higher among Latinos regardless of the metropolitan area that they inhabited.

The unemployment rate percentage grows when more peo-
3.0. **RESULTS**

People are without work and are actively seeking work. The independent variables are the native-born and Latino population in three metropolitan statistical areas: Boston-Worcester-Lawrence, MA-NH-ME-CT, Chicago-Gary-Kenosha, IL-IN-WI, and Los Angeles-Riverside-Orange County, CA. The native-born in Boston experienced the lowest amount of unemployment at 6.5%, followed by the native-born of Los Angeles who had an unemployment rate of 8.5%. The Latino population of Boston experienced the highest unemployment rate at 10.6%, followed by the Latino population of Chicago who had an unemployment rate of 9.3%. In 2010, the unemployment rate was notably higher among Latinos across these metropolitan areas.

The dependent variable is median household income. The independent variables are the native-born and Latino populations in three metropolitan statistical areas: Boston-Worcester-Lawrence, MA-NH-ME-CT, Chicago-Gary-Kenosha, IL-IN-WI, and Los Angeles-Riverside-Orange County, CA. The Latino population of Boston had the lowest median household income of $37,871, followed by the Latino population of Los Angeles who had a household median income of $45,781. The native-born population of Boston had the highest median household income at $66,850, followed closely by the native-born population of Chicago who had a median income of $64,639. In 2000, median household income was noticeably higher for the native-born populations compared.

The dependent variable is median household income. The independent variables are the native-born and Latino populations in three metropolitan statistical areas: Boston-Worcester-Lawrence, MA-NH-ME-CT, Chicago-Gary-Kenosha, IL-IN-WI,
and Los Angeles-Riverside-Orange County, CA. The Latino population of Boston had the lowest median household income of $35,703, followed by the Latino population of Los Angeles who had a household median income of $45,271. The native-born population of Boston had the highest median household income at $68,020, followed closely by the native-born population of Los Angeles who had a median income of $65,628. In 2010, median household income was noticeably higher in the native-born populations of the three metropolitan areas.

From 2000 to 2010 unemployment for the native-born population more than doubled, increasing an average of 105%, far higher than the average increase of 6.33% in Latino unemployment. The native-born population of Boston experienced the highest percentage increase of unemployment, 124% (from 2.9% in 2000 to 6.5% in 2010), followed by the native-born population of Chicago, which experienced a percentage increase of unemployment of 110% (from 4.1% in 2000 to 8.6% in 2010), followed by Los Angeles who had a percentage increase of unemployment of 88.8% (from 4.5% in 2000 to 8.5% in 2010). The Latino population of Boston experienced a percentage increase of unemployment of 11.8% (from 9.48% in 2000 to 10.6% in 2010), followed by the Latino population of Chicago who experienced a percentage increase of unemployment of 10.7% (from 8.4% in 2000 to 9.3% in 2010). The unemployment rate of the Latino population of Los Angeles decreased by 3.2% from 2000 to 2010 (from 9.3% in 2000 to 9% in 2010).

From 2000 to 2010 Latino household median income decreased in all three metropolitan cities, while the native-born population had mixed results. Latino household median in-
come decreased 13.7 percent in Chicago (from $52,481 in 2000 to $45,293 in 2010), 1.1% in Los Angeles (from $45,781 in 2000 to $45,271 in 2010), and 5.7% in Boston (from $37,871 in 2000 to $35,703 in 2010). Median household income for the native-born population in Chicago decreased 7.3% (from $64,639 in 2000 to $59,930 in 2010), increasing 12.3% in Los Angeles (from $58,126 in 2000 to $65,268 in 2010) and increasing 1.8% in Boston (from $66,850 in 2000 to $68,020 in 2010).

**Discussion**

My hypothesis that immigrant Latinos experienced a higher level of unemployment and a more sharply decreased median income than the Native-Born population of the U.S after the Great Recession of 2008 was somewhat confirmed by my results, but remains largely inconclusive. After the 2008 recession the immigrant Latino population in all three of the metropolitan cities tested showed a larger decrease in median income than the Native-Born population, which was what I expected. However, unemployment data showed the opposite effect: in all three cities, the Native-Born population experienced much greater increases in their unemployment rates than the immigrant Latino population in all three metropolitan cities after the Great Recession.

I attribute the unexpected unemployment results to the limitations of the unemployment rate indicator. The base unemployment rate doesn’t account for people working in the underground labor market, and it also includes those that are work-
ing part-time, a major point of contestation by critics. From 2000 to 2010 the Latino population in the three metropolitan experienced an average increase in unemployment of 6.4%, insignificant in comparison to the 107.6% average native-born unemployment rate change in 2000-2010. However, the Latino population in the three metropolitan cities started with an average unemployment rate of 9.06%, 136% higher than the 3.83% average unemployment rate in 2000 among native-born populations. If the Great Recession affected the native-born population so negatively in terms of unemployment, then I would speculate that a somewhat proportionate increase in unemployment would take place for the Latino population as well. I believe the data didn’t show this proportionate increase in unemployment because it doesn’t take into account Latinos who work in the underground economy, who get paid “under the table” and don’t report their job status to the Census Bureau or the IRS. As a result the amount of Latinos who were laid off in the informal labor market after the Great Recession wasn’t recorded, which suggests that the real unemployment rate among Latinos is underreported. The number of native-born in the informal job market would also be underreported due to the structure of the unemployment indicator, but native-born workers are a much smaller share of the informal labor market. This skews the change in reported unemployment and makes the unemployment data somewhat unreliable.

The data show that the immigrant Latino population experienced much more of a percentage decrease in the average median income from 2000 to 2010 than the native-born population. This suggests that immigrant Latino wages may be more
flexible than the wages of the native-born population. One of the reasons why this may be is that the Latino population on average works more low-skill and low-wage jobs than the native-born population. These jobs do not require a large amount of human capital, and as such, there are many more people who are qualified to work these jobs. On the other hand, high-skill jobs cannot be performed by just anyone, and as such wages may stay high in order to keep the high-skill worker from leaving the job. Migrants may be more willing to accept lower wages, because as low-skill workers they may not have much of a choice. Contrarily, the high-skill worker may be able to keep his wages from decreasing due to the human capital he possesses.

Immigrants, including the Latino population, unambiguously improve economic conditions, employment, productivity, and average income in the long run. In the short run, especially during an economic recession, new immigrants can hinder native and non-native employment. I believe then that the United States would benefit most from immigration policies that adjust to the economic climate. Illegal immigration somewhat already responds to economic downturns, and when the Great Recession occurred illegal immigration flows dropped dramatically while legal immigration remained relatively unchanged. One way we can deal with legal immigration so it conforms to the contraction of the business cycle is to use the demand for work permits as a vessel to determine the amount of legal migrants we admit. This would allow the demand of employers to determine the necessary amount of migration that would be optimal for businesses to facilitate employment. Another method that could be used would be to admit a growing amount of migrants during
times of economic growth, while allowing a fixed amount of legal migrants to obtain visas during times of economic downturns. Although we tend to favor high skill migrants, a percentage of visas should be given specifically to low wage laborers in an economic downturn. This may serve to reduce the low skill workers who wish to travel to the US illegally, while giving legal jobs to low skill workers who do manual labor jobs that the native-born population tends to shun. I believe it is in the country’s best interest to craft an immigration policy that is flexible, which shifts when economies contract, and that take advantage of immigration when economies experience growth.
Bibliography


Chapter 4

The Government’s Share of Health Expenditure: Effects on Life Expectancy & Healthcare Cost Efficiency
William Thorne, University of Massachusetts Amherst

Introduction

The healthcare debate in the United States has brought a great deal of controversy, bringing forth charges of bureaucratic inefficiency and wasteful government spending. The United States has a disappointingly low life expectancy for the enormous amount of government health expenditure per capita in the US compared to other developed countries. However, despite spending so much as a nation, the U.S. government’s expenditure accounts

1wbthorne@umass.edu
for a relatively small percentage of overall healthcare spending in America. Hovering at around 45% for the last ten years, American government healthcare spending is dwarfed by the United Kingdom, Sweden or even the “austere” Germans with 80%, 81% and 75% respectively in 2011 (World Bank, 2013). The populations of all of these European countries were expected to live at least a year longer in 2011 than their American counterparts (World Bank, 2013). Examining this significant discrepancy in life expectancy, highlighted further by how much more private citizens of the United States spend on healthcare, led me to investigate the relationship between public health expenditure and life expectancy. I hypothesized that public health expenditure, as a percentage of total health care expenditures, increases the life expectancy of a nation through expenditure efficiency.

First, I examined a global dataset spanning roughly the last fifty years across countries from all development stages and income levels. To understand the true effect that public health expenditure has on life expectancy, I investigated the role of secondary variables like per capita healthcare spending, sanitation, immunization and percentage of the population with HIV or tuberculosis. Despite expecting some of the effects of increases in public health expenditure to take place years into the future, beyond the scope of my data, I found that life expectancy was affected by public health expenditure. Most importantly, this result is consistent across different model specifications.

This paper is organized as follows: section 1 describes the existing literature relevant to my area of study; section 2 presents the data used and the descriptive statistics performed; section
3 outlines my empirical model; section 4 presents and discusses the results of my analyses; and section 5 concludes by discussing the potential policy implications of my results.

1. Literature Review

There is a growing literature surrounding public healthcare expenditure and life expectancy, both supporting government intervention in the healthcare industry and others supporting private healthcare. A study by Cundiff with the Independent Institute (2010), which examined life expectancy, health care spending and societal factors and how the United States compared to the Organization for Economic Cooperation and Development (OECD). This study found a statistically significant positive correlation between total healthcare spending and life expectancy and a statistically significant negative correlation between obesity and life expectancy, but did not find a statistically significant correlation with respect to my specific topic.

Woolhandler and Himmelstein (2011) have supported health care intervention from the government, but state that the corrupting influence of pharmaceutical campaign donations have likely resulted in the Affordable Care Act not caring for the needs of the people. In a paper looking at the medical effects on bankruptcy showed that 62.1% of bankruptcies were medical debtors according to Himmelstein, Thorne, Warren and Woolhandler (2007), which is a hidden cost of private health care and highlights some inefficiencies of the current system. Commentators like Friedman (2001) believe that the route to solving the
United States medical issues is to get rid of most third party payment like Medicare, Medicaid and employer-provided health insurance and switch to medical savings accounts.

2. Data

My intent to in some ways differ from those who have done research on the subject previously, was to look explicitly towards the effects of public intervention as a positive step in and of itself. To do so I needed to collect a wide dataset to effectively look at public healthcare spending as a whole and less into effects of particular policies in effect in specific countries, despite being initially inspired by the current healthcare debate. The data I collected was first and foremost data from the World Bank relating to: public health expenditure, health expenditure per capita, life expectancy, GDP per capita, population, and also specific health variables like improved sanitation rates, immunization rates, tuberculosis rates and AIDS rates, all of which were broken down by country and fell between 1961 and 2011. Secondly, and less significantly I obtained a much more limited data set from the OECD which had data relating to alcohol consumption and tobacco consumption. Table 1 presents the main variables used in this study, where observations are country-years between 1961 and 2011. The data has not been modified in any way except in excluding categorical variables.

\[2\text{With each observation representing one of hundreds of countries in a given year 1961-2011, there are more than ten thousand such observations, each with a total population in the thousands or millions.}\]
4.0. DATA

Table 4.1: Countrywide Health Statistics for Country-Years 1961-2011 (Source World Bank, *OECD)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Obs</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health Expenditure, Public (%)</td>
<td>3.147</td>
<td>56.889</td>
<td>20.185</td>
<td>0.394</td>
<td>99.976</td>
</tr>
<tr>
<td>Health Expenditure per Capita ($/person)</td>
<td>3.148</td>
<td>676.672</td>
<td>1310.86</td>
<td>0</td>
<td>9120.811</td>
</tr>
<tr>
<td>GDP per Capita ($/person)</td>
<td>7.590</td>
<td>6296.5</td>
<td>1310.86</td>
<td>0</td>
<td>193892.3</td>
</tr>
<tr>
<td>Total Population</td>
<td>10.321</td>
<td>2.44e+07</td>
<td>9.92e+07</td>
<td>4453</td>
<td>1.34e+09</td>
</tr>
<tr>
<td>Urban Improved Sanitation Access (%)</td>
<td>4.041</td>
<td>69.376</td>
<td>31.090</td>
<td>2.3</td>
<td>100</td>
</tr>
<tr>
<td>Prevalence of HIV (%) ages 15-49</td>
<td>2.310</td>
<td>2.445</td>
<td>4.760</td>
<td>0.1</td>
<td>28.2</td>
</tr>
<tr>
<td>Tuberculosis Incidence (per 100,000)</td>
<td>4.292</td>
<td>144.455</td>
<td>191.153</td>
<td>0.22</td>
<td>1826</td>
</tr>
<tr>
<td>Imm. DPT (% children 12-23 months)</td>
<td>5.464</td>
<td>76.70602</td>
<td>24.060</td>
<td>0</td>
<td>99</td>
</tr>
<tr>
<td>Imm. Measles (% children 12-23 months)</td>
<td>5.355</td>
<td>75.263</td>
<td>23.546</td>
<td>0</td>
<td>99</td>
</tr>
<tr>
<td>Tobacco (Grammes per Capita)*</td>
<td>984</td>
<td>2261.771</td>
<td>701.979</td>
<td>660</td>
<td>4463</td>
</tr>
<tr>
<td>Alcohol (Liters per Capita)*</td>
<td>1.513</td>
<td>9.843</td>
<td>4.022</td>
<td>0.8</td>
<td>20.8</td>
</tr>
</tbody>
</table>

such as “World”, “SubSaharan Africa (all income levels)” or “Low Income” which were initially included as countries in the online available datasets from the World Bank and OECD.

Descriptive Statistics

Scatter plots allow for a preliminary exploration of the data and the possible relationships between variables. Outliers and nonapplicable observations are dropped in building the graphs and in running the analysis.

Figure 4.1 explores the basic relationship between life expectancy and public health expenditure, it uses data available in 2011 shows a fairly standard and expected positive relationship. Looking at life expectancy and per capita health expenditure Figure 4.2 creates a quite different result with a very pronounced, tightly clustered and noticeable curve. Figure 4.3 examines the same relationship using the log of health expenditure per capita, the output is a more visually striking linear
In building the model used in this study it is important to also understand the relationship between the two main independent variables: health spending per capita and public health spending. Intuitively, we may think that government spending actually adds to the total spending on health as a whole rather than likely initially displacing some sort of private spending. Figure 4.4. shows the relationship in 2011, that the public health expenditure only really starts increasing the total health expenditure per capita at around the 55-70% range and the really begins increasing quickly from there. To more clearly display the relationship between health expenditure per capita and public health expenditure, I compared the log of health expenditure per capita to public health expenditure in Figure 4.5. After doing so there was clear linear relationship between the two variables that presented itself. On the surface, this relationship would make sense if the two variables were nominal values, but as percentages knowing that countries who decide to spend money on healthcare publicly rather than privately, will also spend proportionally more in percent increases in total healthcare spending per capita, is quite interesting.

In addition to looking at my main variables I compared some of my other variables to one another and to my dependent variable, life expectancy, and to my two main independent variables. In comparing access to proper sanitation to life expectancy I obtained the result in Figure 4.6. Graphing immunization rates for DPT and then again for measles in Figures 4.7 and 4.8, there is a very similar result to above with a linear relationship with a definite cluster near the upper right as the rightward
4.0. DATA

bound of 100% is reached for many fully developed countries. The graphs for tuberculosis rates and HIV rates versus life expectancy in 2011 in Figures 4.9 and 4.10 look very similar to those for immunization of measles and DPT, only oriented in the opposite direction. Taken together these graphs do not look as if they follow a very clear pattern or one that could be easily explained or interpreted aside from the existence of the upper and lower bounds at 100% and 0% respectively.

For tobacco use the data purely from 2011 is not sufficient to get a clear idea of the relationship between it and life expectancy, however the increases sample size allows for a more helpful picture in Figure 4.11. Alcohol has a much more ambiguous or positive effect on life expectancy, which is consistent with past research, based on Figure 4.12, my collected Alcohol data it does not seem to have an obvious effect.

Overall the data collected is pretty impressive for a worldwide data set, however elements of the OECD data fall short of some of the expectations but still show interesting relationships that I can investigate in my research. Particularly interesting are the relationships of life expectancy, public health expenditure, health expenditure per capita, and HIV and tuberculosis rates.
Empirical Specification

I hypothesize that the public share of health expenditure increases the life expectancy of a nation through expenditure efficiency. The public sector could use money on life saving procedures that individuals could not afford privately by their own means, subsequently improving overall life expectancy. In addition, the public sectors support of healthcare could encourage potentially cost-saving preventive care, increasing the life expectancy per dollar spent.

The basic relationship of my model is that the percentage of health expenditure that is public increases life expectancy in two ways. First, government spending could be allocated in ways not solely based on the highest payer, but by medical need. This is demonstrated by, for example, a relatively rich individual in pain vying for doctor’s time, while the doctor might be needed more to save the life of a poorer person. In a health market with no influence of government or regulation, the rich man likely pays more than the poor person, and subsequently receives treatment for what, in life expectancy terms, is trivial. Although clearly an extreme, it is possible to imagine more common examples occurring that when aggregated across an entire country, would ultimately bring down life expectancy for the nation. Conversely, many health care services that could potentially be provided by the government, especially end of life care, might have no effect on life expectancy because the health care spending is used solely for quality of life enhancements. However, my hypothesis is that there is indeed a net positive effect.
Figure 4.1:
Figure 4.2:
4.0. EMPIRICAL SPECIFICATION

Figure 4.3:
Figure 4.4:
Figure 4.5:
Figure 4.6:
Figure 4.7:
Figure 4.8:
Figure 4.9:
Figure 4.10:
Figure 4.11:
Figure 4.12:
Figure 4.13: Flowchart depicting the relationship between the main variables
The second effect by which I hypothesize that percentage of public health expenditure increases life expectancy is that by encouraging and subsidizing health care, people will choose to spend more money than they might normally spend on their health. Essentially, government health expenditure is not just replacing private spending, but both supplementing and adding to it. This increase in per capita healthcare spending then goes on to increase life expectancy normally, that is as if it were private healthcare expenditure.

An interesting consequence that could result of these dual means of increasing life expenditure through public healthcare would be that even if the first effect is negligible, or even negative, so long as the second effect is significant enough to be observed beyond that of the first effect, increased percentage of government expenditure could still be a net positive for life expectancy.

Besides the fundamental variables in my model, I have included the variables: immunization rate, HIV prevalence rate, tuberculosis rate, sanitation rate, and tobacco and alcohol consumption per capita. I would expect immunization to positively affect life expectancy, while also being positively correlated with public health care spending because the government could be providing immunizations to the public. HIV rates would be expected to be negatively correlated with life expectancy, as people are more likely to live shorter lives with HIV. However, as opposed to immunizations, HIV prevalence might be expected to be independent of health expenditure, public or otherwise. Since there is a lack of immunizations or a cure for HIV, the more relevant driver likely comes from an education standpoint.
4.0. **EMPIRICAL SPECIFICATION**

and not from a health expenditure standpoint. Tuberculosis, on the other hand, reduces life expectancy (like HIV), but instead has some more direct element of prevention as a vaccine, which means that tuberculosis rates would be expected to be negatively correlated with public health expenditure and health expenditure per capita.

Urban population access to improved sanitation is a more ambiguous variable as opposed to the more directly health related variables mentioned earlier. Its ambiguity stems from the knowledge that although expected to be positively influential to ones health, urban access to sanitation is less plausibly considered to be directly a result of health expenditures. In addition, the inhabitants of urban areas could vary drastically and so might not be consistent with variables like GDP per capita. In many countries the urban population might be considered the poorest populations, where elsewhere the urban population is the center of wealth, surrounded by destitute rural areas. These nuances might not be accounted for within the data, however the potential substantial effect on life expectancy makes it a necessary variable to observe.

While each variable previously had a large amount of data from the World Bank, the variables of alcohol and tobacco consumption have less than 50% and 75% of the number of observations as HIV prevalence, respectively. Despite the smaller number of observations, their inclusion was ensured by the thought that my model naturally assumes some causality between health care spending and life expectancy. However, I became aware of the possibility that causality may potentially move in the other direction. Countries with more healthy conscious citizens
might choose to spend more money on healthcare because it is something they value highly. The health conscious evaluation of healthcare as an important and worthy expenditure might show that an increase in spending resulted in improved life expectancy, when really the increased life expectancy was merely a result of their health-conscious lifestyle. This highlights the importance of variables that might indicate if this scenario is indeed the case. Tobacco, and to a less extent alcohol consumption (and obesity where the global data is available), might give some indication of how health conscious a nation is and give some clearer picture of the direction of the causality in the model.

Model

The model is informed by the relationships and data described thus far. It includes life expectancy, in years, as the dependent variable, with the following independent variables: public health expenditure (%), per capita health expenditure, HIV and tuberculosis rates, sanitation, immunization of DPT and measles, and tobacco and alcohol consumption.

The basic model can be described by the equation \( L = c + \alpha x + \beta y \), where \( L \) is life expectancy, \( x \) is public health expenditure and \( y \) is health expenditure per capita, with \( \alpha \) and \( \beta \) the coefficients of \( x \) and \( y \), and \( c \) the intercept of the equation.
4.0. Results

Results for the simple regression of the basic one variable model are presented in Table 2, [basic]. The findings were $\alpha = 0.1452$ and $\beta = 0.0033$, with $t$-values of 18.13 and 25.82 for public health expenditure and health expenditure per capita respectively and an adjusted $R^2$ of 0.3380.

To make this model more rigorous, fixed effects can be added to the model to obtain regression results with less bias in cases where panel data is used. New approximations for the coefficients were $\alpha = 0.0247$ and $\beta = 0.0012$ with $t$-values of 4.60 and 16.36 [Table 2, basic_fe].

I progressively expand the basic model with fixed effects to include a more comprehensive amount of independent variables. The basic fixed effects model with health expenditure per capita can be described by

$$L = c + 0.0247x + 0.0012y.$$ 

A possible modification of the above model includes an $x^2$ term, denoting the possibly parabolic structure of public health expenditure, which increases life expectancy less and less as the percent of public health expenditure goes from 0% to 100%.

The equation for this regression is as follows [Table 2, basic_x^2]: $L = c + 0.00047x^2 + 0.00117y$ with $t$-values of 4.12, 2.84 and 16.41 for $x$, $x^2$ and $y$.

This equation has interesting implications in that it suggests
a theoretical possible maximizing value of x, the optimal proportion of public spending devoted to public health in order to receive the greatest life expectancy benefit. If this relationship were found to be robust and externally valid it could have significant effects on policy.

Adding some of the variables for health and disease into the basic regression yields the following results for coefficients and equations with t-values for the coefficients labelled beneath:

\[ L = c + 0.0297x + 0.0071y - 0.9714 \% \text{HIV} \], [Table 3, (1)].

\[ t\text{-values: 4.01, 13.83, -18.37} \]

\[ L = c + 0.0187x + 0.0011y - 0.0128 \text{[Tuberculosis per 100, 000]} \], [Table 3, (2)]

\[ t\text{-values: 3.84, 17.29, -25.52} \]

\[ L = c + 0.0061x + 0.0010y + 0.2865 \% \text{Sanitation} \], [Table 3, (3)]

\[ t\text{-values: 1.35, 16.17, 33.86} \]

\[ L = c + 0.0135x + 0.0011y + 0.0938 \% \text{Immunization DPT} \], [Table 3, (4)]

\[ t\text{-values: 2.75, 16.47, 23.52} \]

\[ L = c + 0.0176x + 0.0010y + 0.0908 \% \text{Immunization Measles} \], [Table 3, (5)]

\[ t\text{-values: 3.54, 15.31, 21.54} \]

\[ L = c + 0.0362x + 0.0009y - 0.1458 \text{[Alcohol Liters per Capita]} \], [Table 3, (6)]

\[ t\text{-values: -2.97, 22.78, -2.42} \]

\[ L = c - 0.0589x + 0.0005y - 0.0023 \text{[Tobacco grams per Capita]} \], [Table 3, (7)]

\[ t\text{-values: -3.71, 9.30, -9.38} \].

The addition of these variables created varied results with regard to tobacco and alcohol but otherwise remained fairly consistent. It is likely the extreme variation of tobacco and alcohol is due to the enormous variation in sample size between the many other variables, and alcohol and tobacco.

Of the variables mentioned I analyzed the results of the linear
equations, and then checked regressions of the effect of public health expenditure on the other independent variables. The possibility that the public expenditure often directly affects things like immunization rates, would throw off the effect of public expenditure itself [Table 4]. Excluding the variables that were shown to be significantly affecting public health expenditure, and could probably be considered dependent on public health expenditure or health expenditure per capita for the sake of this model. In addition to the variables which may contain significant selection bias within the context of this model because of their focus on particular countries, and with less substantial data that were obtained from the OECD. My final empirical model can be described by these equations [Table 5.]:

\[ x = \text{Health Expenditure Public, } (%) \]
\[ y = \text{Health Expenditure per Capita } ($/\text{person}) \]
\[ h = \text{Prevalence of HIV } (%) \]
\[ t = \text{Tuberculosis Rate per 100,000 people} \]

Equation 1.
Excluding Health Expenditure per Capita, significant at 99%, 95% for \( x^2 \) term.
\[ L = c + 0.1028x - 0.0007x^2 - 0.3644h - 0.0109t, c = 62.7672 \]
Or, [Equation 2.] Including Health Expenditure per Capita, significant at 99%, 95% for \( x^2 \) term.
\[ L = c + 0.0979x - 0.0007x^2 + 0.0061y - 0.5121h - 0.0093t, c = 62.3429 \]

The resulting estimations are significant, and were generally expected with the exception that the tuberculosis rate was ex-
pected to have been more related to public health expenditure than it truly was. The need for two equations is to parse out the effect of the health expenditure per capita variable on the rest of the equation, because its position as ultimately necessary, but being influenced by the public health expenditure makes the model more complex. It is quite possible that health expenditure per capita variable could be found to be a function of public health expenditure among other things, but that is not the focus of this research.

One of the most interesting conclusions that we can draw from the equations given, is that because of the definition of the equation, ceteris paribus, the equation for life expectancy becomes a quadratic function of public health expenditure as a percent. More interesting still, is that the nature of a downward facing quadratic equation implies that there exists an $x$ such that $L$ is maximized. From a policy standpoint, the implication that there is a way to maximize life expectancy by adjusting public health expenditure is a very interesting proposition.

If we hold the other variables constant, and solve for $x$ in [Equation 1.] when $L$ is at its maximum, we find that public health expenditure as a percent of total health expenditure ($x$) is 73.43% to maximize life expectancy. In addition, that maximum percentage adds 3.7742 years to life expectancy, a sizable difference. If we likewise solve [Equation 2.] to find $x$, or the ideal public health expenditure to maximize life expectancy we find that $x$ is 69.93%. The equation maximization in [Equation 2.] would account for a 3.4230 year increase in life expectancy.

Using data from all available years in the world bank data set, and constructing a scatter plot with a shaded area centered
4.0. RESULTS

around the average of our two calculated maximum values a standard deviation of public expenditure wide, it can be seen that is the highest region on the graph on average [Table 1].

This higher than average maximum value gives credence to the policy ideas of countries who have proposed national health care or more comprehensive public health care. In the United States, policy makers would have to increase the governments share of total health expenses by roughly 30% to reach the maximizing value predicted by my model. This would gain us, conservatively, 0.435 of a year on our average life expectancy, without increasing net health care costs a dime [Equation 2]. Thinking about health care costs in this fashion to maximize the benefit we gain communally is the best way to act on policy decisions going forward. Of course there are other metrics that measure more specific things relating to healthcare that are outside the scope of my model, but working with those decisions in a similar economic benefit maximizing way could create great strides in overall healthcare productivity at much more efficient costs.

There are some issues within my model that I could not fully investigate for a variety of reasons. Not least of them is the lack of healthcare data with the nuance necessary to take a closer look at the relationships within my model. Things like health care costs country by country in a timeseries or quality measures of some sort would be useful, though the latter seems inherently difficult to collect data for. Secondly, a longer time line, to at least measure the effect over a lifetime would be extremely interesting, especially because of the potential for lagged effects, which havent been accounted for in my model. Long term benefits would further support the positive influence
public healthcare expenditure can create. Additionally, the data from the OECD had gaps and holes, in addition to far fewer and not as diverse a group of countries from which to pull data from. The depth that could be added to the model I have created with the help of a full dataset of tobacco use, alcohol use and obesity rates, is a shame to have missed. As it stands now, I could not run a regression using both tobacco and HIV, because they shared no common data points.

Conclusions and Policy Recommendations

I would conclude that for the majority of countries, it would be prudent to address or at least observe and record how large of a part that the government plays in helping to pay for healthcare. In addition to the equity issues, there are savings to be made at a time when politicians, as they do in the United States, are debating over deficits constantly. If the U.S. did in fact increase government’s share in health care expenses to the predicted maximum, while avoiding the life expectancy increase, by cutting total health expenditure in proportion, they would save $71.31 per person according to [Equation 2]. Whether the number of dollars saved is precise or not is not the heart of the issue. The idea that a country might actually save money, by increasing the share of healthcare expenditure spent by the government, is a seemingly unheard of idea given the rhetoric used to discuss national healthcare programs.
Even if the model I have constructed were to be verified, and the results could be considered fact, there would still be the need for sensible discussion and a focus on economically efficient legislation. If we were to truly take these findings in stride while implementing economical legislation, and using our resources in a more efficient manner, we could find ourselves living within our means while continuing to improve and push our standards of living forward. While that may seem like a distant ideal, the steps toward that goal have the potential to save us money and keep us living longer.

Further research could take advantages of improved data in the future, build on and improve the model I have created, accounting for intervariable interactions to a much greater degree. Availability of worldwide data could allow for specified grouping based on economic or policy differences and adapt the model to specialize more successfully. Additionally a deeper investigation into the issue of how time affects my model, as health expenditure influences life expectancies of people 30, 40 and 50 years from now which would remain undetected using my current methods. I hope to continue to build and improve on the model myself to create a more robust and substantial statistical model for the effects of public health expenditure on life expectancy.
### 4.0. RESULTS

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(1) Basic, (2)Basic_fe, (3)Basic_x2.

Note: For all tables, t statistics in parentheses.
*: $p < 0.05$, **: $p < 0.01$, ***: $p < 0.001$
### Table 4.3: More models predicting life expectancy, "lifeexp"

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**p < 0.05, ***p < 0.01, ****p < 0.001
Table 4.5: Two small models of life expectancy

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Bibliography


Chapter 5

The Undergrad’s Dilemma: n-Person Games and Information Asymmetry in Undergraduate Course Selection
Michael Verlezza, Bridgewater State University

Competitive Forces: A Marshallian Approach to Course Selection

Building on the work of Alfred Marshall, generations of economists have used supply and demand curves plotted along two axes, typically labeled “price” along the vertical axis and “quantity” along the horizontal one. While the Cartesian graph itself is used to describe a variety of theoretical relationships – in The General Theory Keynes describes interest rate effects of changes to the money supply, a relationship which would be later fitted.

\[ mverlezza@student.bridgew.edu \]
to another famous graph – it is useful to use the idea of supply and demand as interacting forces to explain an array of economic phenomenon (Keynes, 1936).

The Supply of Education

In an economic sense, this paper treats the “supply of education” as the quantity of classes offered in a particular subject, but a more specific approach — treating every individual seat in each separate course — is a viable alternative, particularly when investigating the issue of course selection from an individual perspective. At the larger institutional level, it is more sensible to take the class-by-class approach. Over the course of this paper, various scenarios will call for a course-level approach, a seat-based approach, or a combination of the two.

It is important to establish a few assumptions. First, it is important to establish that for this analysis individuals are treated as intrinsically selfish. It is also important to acknowledge that seats in a class are effectively private goods — they are both rivalrous and excludable. Rivalrous goods are those goods that their consumption by one person precludes the consumption of the same good by another. Excludability is the notion that people cannot access a specific good without incurring some cost. The finite nature of seats or classes offered ensures the logical underpinnings of these assumptions.

Stemming from these assumptions are a few key observations. First, students will follow a selfish path through their degree programs, seeking to optimize their own well-being through course selection and continued enrollment. Second, the finite
number of seats and classes creates competition (for a preferred professor, a particular course, and a specific time for an offering). Third, this competition creates winners and losers in the higher education system.

The answer, however, is not an increase in supply — neither in the form of additional seats or additional course selections. Braess’ paradox tells us that merely adding additional capacity will reduce overall performance across the system. This will have systemic implications as the additional choice creates added confusion, a scenario only avoidable if the system was in Nash equilibrium to begin with. Braess tells us that students perceiving an easier path will flock to the new alternatives, while others vacillate between offerings. It has been shown that this dithering creates a less optimal selection strategy, which remains until Nash equilibrium is reestablished. In the interim, this allocation of resources (here taking the form of seats in a course) is less than ideal. Students (as has been shown to be the case in various studies involving motorists, who must also make series of selections and update information on the fly) continually re-rank their options, falling back reliably on rational self-interest (Braess, 2005). Conversely and perhaps counter-intuitively, limited selection may lead to fewer idle classroom resources.

The Demand for Education

The escalating price tag of higher education over the last half decade has created an environment conducive to an investigation of buyer behavior. One study in particular has demonstrated the inelasticity of higher education. Consequently, students will
continue to purchase higher education without regard to increasing costs (Rivera, 2012).

Historically, the understanding was that cultural and familial mores were a powerful motivator driving the demand for higher education. While there is indeed a social component, more recent analyses suggest that the biggest driver of continued pursuit (or return to) higher education comes from a student’s peer group. In their 1965 analysis, McDill and Coleman evaluated the various factors that drove college enrollment. To their surprise, while familial influences (educational attainment of previous generations, parental income, etc.) were a factor, they were not nearly as influential as initially assumed. In their model, the variable with the most explanatory power was social standing — peer pressure in common parlance. For McDill and Coleman, high school students entering college are doing so simply in an effort to “keep up with the Joneses.”

There is also the widespread expectation that higher levels of educational attainment drive higher income potential later in life. David Card’s comprehensive work on the subject brings the relationship between years of education and income into clear focus. His 1999 paper demonstrates that the relationship is essentially logarithmic in nature. On balance, more schooling does in fact lead to higher mean wages. By looking at earners between the ages of 40 and 45, Carr is able to account for people with decades in the workforce, avoiding any biases that might arise from institutional prestige or underpaid entry-level work. When held against data from the Bureau of Labor Statistics (2013), Card’s research lays plain the relationship between educational attainment and income potential: those with a college
education will fare far better than their less-well educated peers.

**Other Economic Considerations**

In May of 1991, the entire Ivy League, along with the Massachusetts Institute of Technology, faced a complaint from the Justice Department regarding the manner in which they set tuition prices. All but one school named in the action (MIT) settled the complaint. In response, the Justice Department was forced to issue a decree specifically “preventing... schools from jointly fixing tuition or financial aid awards or and from exchanging financial aid information on admitted applicants” (Morrison, 1992). Knowing that this was a common practice going back to at least the 1980s, it is impossible to discuss the economics of higher education without at least a cursory treatment of cartel pricing.

Cartel pricing stems from the notion that a group of ostensible competitors would agree, formally or informally, to set market prices for their product. In the case of the Ivy League and MIT, this took the form of tuition and financial aid packages, ensuring the cartel could guarantee abnormal financial gains for themselves while extracting value from students. Collusion was simple in the Ivy League due the small number of firms involved, but in the present regulatory environment and in a nation that boasts hundreds of colleges and universities, cartel pricing of higher education on a larger scale would verge on the impossible.

It may go without saying, though, that institutions of higher education have the monopoly on higher education. That said,
schools are not perfect substitutes for one another, creating an environment of oligopoly. While the Cournot-Nash model of oligopoly is the simplest, it is perhaps not the most appropriate, given the dominant nature of prestige institutions in various parts of the country. With a dominant firm model, there is a single firm (or handful of firms) that control the market, be it through product differentiation, branding, or other aspects. As a result, the entire market follows the pricing model of the dominant firm. In the Boston area, it would be hard to argue against the fact that the dominant firm is Harvard. In this instance, reality closely follows economic theory. According to data from the provosts of both Harvard and Bridgewater State University, Harvard tuition (in nominal dollars) has gone from $13,085 in 1990 to $33,656 in 2010, while Bridgewater State tuition has gone from $1,788 to $6,603 over the same time period. By increasing their prices so dramatically over the previous two decades, other universities in the area have been forced to keep pace. This demonstrates the dominant firm oligopolistic model and explains rising prices across the board.

In this introductory and admittedly high-level analysis, it would seem that students and their peer groups are not the only entities trying to “keep up with the Joneses.” Interestingly, higher education seems to follow similar paradigms on both the demand and supply sides.
Strategic Course Selection - A Game Nobody Really Wins?

Having established the underlying economic forces at the core of higher education, it is possible to begin an investigation as to how students end up in various courses. Anecdotally, it has been suggested by students themselves that rarely is a semester comprised of an ideal combination of courses, times, and professors. This is attributable to a variety of forces, and this section will approach the problem from a trio of more advanced economic concepts, from which I derive an additional explanatory economic construct. It is important to introduce three more advanced mechanics in order to arrive at the fourth. With these additional mechanics in place, we can move on to a real-world example of how to an econometric analysis.

n-Person Games

In his seminal work, *Non-Cooperative Games*, John Forbes Nash improved on existing zero-sum game theory originally introduced by John von Neumann. By treating individuals as competitors rather than parties in collusion, Nash assumed “that each participant acts independently, without collaboration or communication” (Nash, 1951). For the purposes of this analysis, we can treat individual students as competitors in a zero-sum, non-cooperative \( n \)-person game. Nash’s work dictates that there is an ideal outcome whereby in a finite system such as a college registration environment, there is an equilibrium point at
which every member of the community enjoys the best possible outcome (within the constraints of said system). The underlying mathematics that Nash uses to establish that equilibrium point is beyond the scope of this paper. Nonetheless, it is important to start with the assumption that there exists an ideal scenario whereby everyone in the system, in a manner of speaking, “wins.”

In practice, however, Nash’s model is insufficient. Consider a binary state whereby two competing parties employ strategies \( i \) and \( j \) in an effort to build the ideal schedule. Nash’s model would suggest that an equilibrium point exists at the intersection of the two strategies, whereby both parties (students) would get everything they want. While Nash equilibrium would suggest academic harmony, it is rarely practical in the typical course registration setting. Frequently, students get a mixed bag consisting of some combination of ideal courses and other, less useful options. Thus, Nash’s model requires two substantial modifications: the presence of strategic dominance and intran- sivity.

In the case of strategic dominance, assume students Alice and Bob are employing strategies \( i \) and \( j \) in order to build their ideal schedule. In the case of course registration, strategy can be defined as the courses needed to maintain full time enrollment, progress within a major, complete prerequisites, etc. The problem arises from the competitive nature of course registration and the rivalrous, excludable nature of the good being sought. Nash’s original mathematical model incorporates the competitive and non-collaborative nature of these processes, but overlooks the notion that there exists a strategy \( i \) which will always
yield a superior result. Moreover, while our example has a binary state of two students employing only two distinct strategies, in reality there are as many different strategies as there are students. In the context of course registration, strategic advantage will most typically arise from two factors — priority registration and academic standing.

The consequence of prioritized registration leads to a second requisite modification to Nash’s original insights. Intransivity, in economic terms, refers to an individual acting in a manner inconsistent with their self-interest. In our game of course registration, we can think of this as Alice or Bob self-assigning (effectively relegating) themselves to inferior strategy $j$. In practice, we see this frequently among the population of underclassmen, who are forced to enroll in courses that are not necessarily their first choice, either for one or for an array of reasons. As this paper will go on to demonstrate at the end of this section, it is possible to employ set theory to express the effects of strategic dominance and intransivity within the context of $n$-person games. Later still, we will see a modified model with the potential to incorporate not only individual preferences and the natural “pecking order” of undergraduate registration, but also the virtually infinite combinations of possible schedules within a variety of parameters.

**Information Asymmetry**

Treating course registration as a competitive $n$-person game as we are, any discussion would be incomplete without the incorporation of information asymmetry. The notion was originally
introduced by the economist Joseph Stiglitz in his 1992 paper, in which Stiglitz suggests that information is a critical component of any economic system. Specifically, his paper dealt with the implications of imbalanced information between buyers and sellers in credit markets, but the economic tools he introduced can easily be scaled down and applied to microeconomic decision-making.

In virtually any exchange, there is an unbalanced relationship between knowledge held by the seller and the knowledge held by the buyer. In the case of higher education, the underinformed buyer is clearly the student, while the school (or more specifically, faculty and staff) maintain a more solid understanding of institutional policies and academic requirements. In our $n$-person game where there existed strategies $i$ and $j$, the problem arises when neither of our students (Alice and Bob) truly understand all the variables that may affect their decisions, and thus cannot adequately account for them strategically.

To remedy the gap, students seek sources of external information. This can be problematic for a variety of reasons, because as Stiglitz (1992) tells us, not only is the cost of accumulating additional information increasingly expensive, but it delivers marginal benefit at a decreasing rate. The dynamic is further complicated by the realities of navigating the world of higher education for undergraduates — reliable information is only occasionally gleaned. The possibility of a student developing a given strategy which will actually engender maximum utility when that strategy is predicated on inaccurate or incomplete information creates problems for our $n$-person game. Fundamental concepts in information economics tell us that in-
formation may be easy to create but is virtually impossible to verify. The consequence for students is strategy rife with error — a scenario that leads to intransivity.

As a way to demonstrate the dangers of external information sources, the econometric component of this paper will examine the relationship between enrollment and one specific external source of information, the infamous ratings website RateMyProfessors.com. While additional detail follows below, it is worthy of note here that in our \( n \)-person game, the relationship between enrollment in a specific course having \( m \)-tuple parameters is statistically significant, suggesting that students may, in reality, be predicing their course selection strategies on less than trustworthy sources.

**Pareto Optimality**

The Italian economist Vilfredo Pareto originally applied his understanding of resource allocation to income distribution. Like Nash’s strides in game theory and Stiglitz’s introduction of information asymmetry, Pareto Optimality (frequently referred to interchangeably as Pareto Efficiency) can be couched in terms of higher education. In fact, it is perhaps the easiest of the three to see at work at a university, as Pareto Efficiency deals specifically with microeconomic outcomes — in short, Pareto Efficiency exists when no one party can be made better off without making another party worse off (Barr, 2012).

Optimization under Pareto Efficiency is predicated on a pre-existing allocation of goods. Typically this is done randomly or treated as a given for the purposes of economic modeling.
In higher education, this would be equivalent to enrolling every student in a full roster of randomly assigned classes. From there, Pareto Improvement takes place as members of the undergraduate community exchange seats in various classes to more closely align their realized schedule with their established strategy. While such a mechanic is impractical, it does demonstrate the viability of Pareto’s optimal distribution of resources, and ultimately, how it aligns with Nash’s notions of equilibrium.

The difference between equilibrium states for Pareto and Nash, however, is that Pareto’s scheme is predicated on a good-faith exchange of resources amongst participants in the system. While it’s true that a form of equilibrium state emerges, that state would be dominated by students with a handful of desirable classes (and likely one or two courses they would rather not take, or have no use for). From the perspective of the student, this outcome is anything but efficient, even though it aligns with Pareto’s understanding of optimal outcomes. Because of the finite number of seats and finite number of classes, it becomes impossible for any one student to improve their lot without doing so at the expense of another student. To complicate matters, the risk of aggregate disutility and inefficiency grows exponentially with every additional member of the academic community.

While institutions do not assign courses with various parameters randomly, the implications of a system predicated entirely on Nash or Pareto is clear, particularly in light of the costs associated with information gathering on the demand side. Consequently, the traditional institutional model of offering several hundred different courses having various attributes then leaving
students to sort out the mess is a broken paradigm. It is a relic. It is an artifact of a system predicated on an irrational expectation of students and an inherently flawed method of distributing information.

Let $S$ denote the range of all student strategies.
Let $s$ denote an individual strategy such that $s \in S$.
Let $U$ denote the range of all possible utility outcomes.
Let $u$ denote an individual utility outcome such that $u \in U$.
Let $i$ and $j$ be individual students having course selection strategies $s_i$ and $s_j$.

$\forall S, (s_i \neq s_j) \rightarrow (u_i \neq u_j)$. 

$\therefore (u_i + u_j + \cdots + u_n) < U_{\text{max}}$ for $n$ number of students.

Equation 5.1 – Mathematical Model of Existing Course Selection Strategy
Involuntary Equilibrium

By synthesizing an analysis of strategy and outcomes in $n$-person games, the effects of student reliance upon asymmetric information, along with the concept of Pareto Optimality, the implications are clear. A group of competitors (read as: students) cannot be reasonably expected to arrive at an equilibrium state where every party engaged is maximizing their economic well-being. When we factor in the costs of higher education and the societal ramifications of this waste, a need arises for a new economic concept. From this need, I have developed the concept of involuntary equilibrium.

From a macroeconomic perspective, the effects (and practicality) of a planned economy are well understood (Mandel, 1986). What is lacking is a treatment of how such a macroeconomic construct could be applied to higher education in a way that not only maximizes individual well-being but also the aggregate social benefit of a more educated population. It is clear from the preceding analysis that the traditional free-for-all approach allocating a critical, rivalrous, and excludable good, is insufficient.

Ultimately we can identify that the state (in this case, the state takes the form of a university or other institution) must step in and regulate who takes what and when they take it. The school must work on behalf of the students, as well as society in general, to establish what from the student’s perspective can be referred to as involuntary equilibrium.

Consider the foregoing economic concepts. Nash suggests that if students are left to their own devices, an equilibrium state
5.0. INVOL. EQM.

will emerge amongst students whereby every competitor will get some of what they want, yet by definition they will end up with something less than ideal. The problem with Nash’s model is analogous to the issues that arise with Pareto’s: that what is systematically efficient is a far cry from what is ideal for the individual, and by extension, society. The implications of Stiglitz’s insights create a multiplicative effect for the deficiencies left behind by Nash and Pareto. On average, students looking to ameliorate their standing within the $n$-person game cannot. This is the very definition of the zero-sum game.

Revisiting again the $n$-person game, we identify that the institution already establishes the framework by which students select courses and the mechanic by which they enroll in them. Thus, the institution controls the parameters which would define Nash’s equations. This in turn removes the gamesmanship that arises from various attempts by students to derive a given strategy. Were an institution to offer a sufficient m-tuple combination of possible schedules and take the decision-making process out of students’ hands, the institution has the potential to maximize the efficient use of academic resources. In so doing, the institution ensures that each individual student has the ideal combination of courses having m-tuple attributes.

In conclusion, if we treat the academic institution as a firm, we see that by maximizing the individual benefits of their customers the firm itself holds wasted resources to a minimum. Second, the institution maximizes the broader benefit to society. The benefits of a more educated population (workforce) have been exhaustively analyzed and demonstrated (Judy & D’Amico, 2006). From these two realizations stems an impor-
tant observation — involuntary equilibrium allows a public institution to fulfill their societal mandate by creating the most educated and capable population possible.

Let $S$ denote the range of all student strategies.
Let $s$ denote an individual strategy.
Let $B$ denote a global (or institutional) strategy such that:
$s \in S \in B$.
Let $U$ denote the range of all possible utility outcomes.
Let $u$ denote an individual utility outcome such that $u \in U$.
Let $i$ and $j$ be individual students having course selection strategies $s_i$ and $s_j$.

$\exists B$ such that $(\forall S, (s_i = s_j) \rightarrow (u_i = u_j) \rightarrow \sum_{k=1}^{n} (u) = U_{max}$

\[ \therefore (u_i + u_j + \cdots + u_n) = U_{max} \text{ for } n \text{ students.} \]

Equation 5.2 – Mathematical Model of Course Selection Strategy Under Involuntary Equilibrium
Econometric Analysis

Introduction

As economics is the science of allocating limited resources to address unlimited wants, this paper has, thus far, been a treatment for fitting a virtually infinite number of possible student schedules into a finite quantity of class seats. The econometric component of this paper will inform our understanding of the relationship between various administrative inputs (which take the form of course attributes) as well as external information. In so doing, quantitative analysis will yield policy insights and demonstrate the viability of a registration system predicated on involuntary equilibrium which still has the potential to reflect consumer preferences.

Hypotheses

The quantitative component of this study focuses on various aspects of undergraduate course selection, specifically how assorted course attributes affect enrollment in a given course. If the aim is to allocate classroom resources in the most efficient way possible, such an analysis will provide insights in light of asymmetric information, but also point to the different drivers that contribute to undergraduate course selection. Various null hypotheses are stated below:

$H_1$: Students do not rely on external information sources prior to enrolling in courses. As a result, the coefficients for NOOFRANKINGS, RMPOVRALL, and RMPEASY will be zero.
$H_2$: Web or web hybrid courses are not in higher demand than traditional lecture settings. Consequently, the coefficient for $DHYBRIDWEB$ will be zero.

$H_3$: Junior- and senior-level courses are not in higher demand. Thus, the coefficient for $DUPPER$ will be zero.

$H_4$: Economics courses required for business majors are not in higher demand. As a result, the coefficient for $DCROSSLIST$ will be zero.

$H_5$: Economics courses that satisfy a Core Curriculum requirement are not in higher demand. Therefore, the coefficient for $DCORE$ will be zero.

$H_6$: Economics courses required for the Economics major are not in higher demand. As a result, the coefficient for $DMAJOR$ will be zero.

While not a hypothesis test in the traditional sense, attention should also be given to the mean of $PROPENROLLED$. A mean below 1 indicates unfilled seats.

**Data and Methods**

Data has been gathered from Bridgewater State University’s own course registration and reporting tool, Infobear. Using this system, it is possible to obtain registration and course data going back several years. Initially, the aim of this study was to derive two distinct data sets — one containing all semester registration data from September 2007 to May of 2013 and a sample data set containing all the offerings from the Economics department for the same time period (Infobear, 2007-13).
Since the focus of the study is undergraduate course selection, any graduate Economics courses were purged from the dataset. One-off courses, such as independent studies or internships, were also removed, as neither is a “college course” in the traditional sense. Ultimately, this left the dataset with 465 observations.

A variable was created to represent enrollment in a specific class (labeled in the regression output as PROPENROLLED). It is a simple function whose output is derived by dividing the number of students actively enrolled in a section of a given class by the maximum number of seats in said class. When stated as a proportion, this allows the model to capture the effects of over- or under-subscribed sections, and provides for professorial and departmental discretion in the case of over-enrollment.

A series of dummy variables were created from the categorical data. The first, denoted DHYBRIDWEB, is used to identify if a class is a traditional lecture setting (indicated by a 0), or an online or hybrid offering (indicated by a 1). The second dummy variable is DUPPER, which captures a course’s upper- or lower-division attribute. Bridgewater courses are either 100-, 200-, 300-, or 400-level. 100- and 200-level courses are lower (Freshman and Sophomore) division classes, while 300- and 400-level classes are upper (Freshman and Sophomore) division classes. For this reason, those courses having a numerical designation less than 300 (for example, ECON 210 — Statistics for Economics and Business), are assigned a value of 0. Those courses with a designation greater than or equal to 300 (for example, ECON 420 — Econometrics), are given a dummy value of 1. The third dummy variable is denoted as DCORE
(such as ECON 199), where a 1 indicates that a given course meets a Bridgewater State Core Curriculum requirement. The final dummy variable is DCROSSLIST, which indicates if an Economics course is a requirement for students in other majors (such as ECON 315 — Money and Banking, required by all finance majors, for example). Here, 1 denotes a cross-listed class.

Bridgewater State enrollment data is included in the data. Using information from the BSU Factbook, it is possible to determine the number of undergraduates enrolled in business majors and more specifically, the quantity of declared Economics majors. This was done to provide an important control. As one would expect, a non-Economics major has no use for an upper-division Economics class, with the exception of certain business students who are required to take ECON 315. The number of students enrolled at BSU as Economics and business majors in a specific semester may be the dominant determinant of demand for economics courses. This is an important distinction to make, since the Department of Economics does not fall under the College of Business at Bridgewater. Rather, it is part of the College of Humanities and Social Sciences.

Data from an external information source completed the dataset. By investigating the relationship between enrollment data and external information source completed the datasets, we are able to identify the effect, if any, of students seeking additional information sources about their prospective courses. Data was culled from the external site RateMyProfessors.com, which allows students to evaluate their professors in several ways. All evaluations are conducted on an integer interval from 0 to 5,
with 5 being the best and 0 being the worst possible score. Three data points were collected for every course section: the professor’s easiness score, the professor’s overall score, and as a control, the number of ratings a professor has received. In certain cases, professors had not been evaluated by their students, in which case a value of 0 (rather than null) was assigned for all three variables. This was done to capture the effects of a lack of information. In accordance with existing research (Tipoe, 2013), overall score is calculated as an average of a professors “helpfulness” rating and an evaluation of their instructional clarity. Thus, RMPOVRALL captures both aspects of professorial style.

A final note: Ultimately professor names were removed entirely from the dataset, leaving entirely quantitative data and eliminating the possibility for any personal bias in the results.
### Table 5.1: Summary Statistics for Regression Variables (n=463)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Definition</th>
<th>Mean</th>
<th>Std Error</th>
<th>Min.</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>NOFRANKINGS</td>
<td>Number of professor's RateMyProfessors.com ratings for a given professor</td>
<td>36.3823</td>
<td>26.9679</td>
<td>0</td>
<td>92</td>
</tr>
<tr>
<td>RMPOVRALL</td>
<td>RateMyProfessors.com Overall rating for a given section's professor</td>
<td>3.4116</td>
<td>0.7547</td>
<td>0</td>
<td>4.1</td>
</tr>
<tr>
<td>RMPEASY</td>
<td>RateMyProfessors.com Easiness rating for a given section's professor</td>
<td>3.2181</td>
<td>0.9034</td>
<td>0</td>
<td>4.8</td>
</tr>
<tr>
<td>RMPOVRALL*RMPEASY</td>
<td>Interaction term calculated by multiplying the two previous variables</td>
<td>11.4961</td>
<td>4.5460</td>
<td>0</td>
<td>19.68</td>
</tr>
<tr>
<td>PROPENROLLED</td>
<td>Active Enrollment / Seats Available in a course, representing the occupied proportion of total capacity.</td>
<td>0.8068</td>
<td>0.2946</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>DHYBRIDWEB</td>
<td>Dummy variable - 1 indicates a web-based or hybrid web/lecture course.</td>
<td>0.2981</td>
<td>0.4579</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>DUPPER</td>
<td>Dummy variable - 1 indicates an upper-division class.</td>
<td>0.1620</td>
<td>0.3688</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>DCORE</td>
<td>Dummy variable - 1 indicates a Course that is a Core Curriculum requirement.</td>
<td>0.8034</td>
<td>0.3978</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>DCROSSIST</td>
<td>Dummy variable - 1 indicates an Economics class required by non-Economics degree programs.</td>
<td>0.7970</td>
<td>0.4027</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>DMAJOR</td>
<td>Dummy variable - 1 indicates major is the Economics major.</td>
<td>0.8056</td>
<td>0.3612</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>BUSNENROLLED</td>
<td>Number of students with declared majors in the College of Business for a given year.</td>
<td>1562.75</td>
<td>57.7479</td>
<td>1475</td>
<td>1639</td>
</tr>
<tr>
<td>ECONENROLLED</td>
<td>Number of declared Economics majors in the College of Business for a given year.</td>
<td>58.3585</td>
<td>11.7676</td>
<td>43</td>
<td>72</td>
</tr>
</tbody>
</table>

Notes:
- NOFRANKINGS = Number of professor's RateMyProfessors.com ratings for a given professor.
- RMPOVRALL = RateMyProfessors.com Overall rating for a given section's professor.
- RMPEASY = RateMyProfessors.com Easiness rating for a given section's professor.
- RMPOVRALL*RMPEASY = Interaction term calculated by multiplying the two previous variables.
- PROPENROLLED = Active Enrollment / Seats Available in a course, representing the occupied proportion of total capacity.
- DHYBRIDWEB = Dummy variable - 1 indicates a web-based or hybrid web/lecture course.
- DUPPER = Dummy variable - 1 indicates an upper-division class.
- DCORE = Dummy variable - 1 indicates a Course that is a Core Curriculum requirement.
- DCROSSIST = Dummy variable - 1 indicates an Economics class required by non-Economics degree programs.
- DMAJOR = Dummy variable - 1 indicates major is the Economics major.
- BUSNENROLLED = Number of students with declared majors in the College of Business for a given year.
- ECONENROLLED = Number of declared Economics majors in the College of Business for a given year.
The data was analyzed using Ordinary Least Squares regression in Stata. Evaluating time series data with OLS is not typically undertaken without substantial adjustments (Wooldridge, 2012). However, the manner in which the dataset has been constructed ensures that the regressions that follow utilize cross-sectional data. This paper is not investigating departmental enrollment numbers over time, but rather the various factors that drive enrollment in a given course section. While it is true that the dataset culls information from several semesters, OLS remains a viable analytical tool because of the nature of this study.

As we are dealing with cross-sectional data, it is important to test for multicollinearity before analyzing the model. While some multicollinearity does exist in the models, cross-sectional data devoid of any collinearity is exceptionally rare. Despite a scattering of fairly high collinear relationships, we are nevertheless satisfied that this condition of Gauss-Markov is met. Additionally, robust standard errors were utilized in every model to account for heteroskedasticity. Robust standard errors were chosen because initially a Breusch-Pagan test suggested marginal heteroskedasticity. The output for each OLS regression is in the following table.
### Table 5.2: OLS Estimated Coefficients of Variable Effects on Course Enrollment

<table>
<thead>
<tr>
<th>Variable</th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
<th>Model 4</th>
<th>Model 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>NOOFRANKINGS</td>
<td>-0.002</td>
<td>-0.0002</td>
<td>0.0002</td>
<td>-0.0004</td>
<td>-0.0001</td>
</tr>
<tr>
<td></td>
<td>(0.0006)</td>
<td>(0.0006)</td>
<td>(0.0006)</td>
<td>(0.0005)</td>
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*/**/*** denotes significance at the 0.1 / 0.05 / 0.01 level. All standard errors robust.

### Interpretation of Results

Using Model 1, we reject $H_1$, because of the statistical significance and non-zero coefficient for RMPEASY. As it turns out, a one point increase in a professor’s perceived easiness results in a six percentage point increase in enrollment in their class. This relationship clearly suggests that students are not only seeking outside information, but that they appear to be acting based on that information, further suggesting external information’s role...
5.0. ECONOMETRICS

in the formulation of course selection strategy.

Note too that when we introduce an interaction variable in Model 2, we see that all four dummy variables remain statistically significant. While DHYBRIDWEB is only marginally significant, this model has substantial implications for \( H_2, H_3, \) and \( H_4 \). We reject \( H_2 \), which suggests that there is increased demand for web and web-hybrid courses.

The null is rejected for \( H_3 \). This is because DUPPER is statistically significantly different from zero in every model in which it is included. The coefficient for DUPPER is negative, indicating an upper-level class lowers the likelihood of filling the seats in the class.

The null is rejected for \( H_4 \). DCROSSLIST is highly significant, and the positive coefficients suggest that students from the College of Business are demanding the Economics courses required for their majors. This is an unsurprising result.

The null is also rejected for \( H_5 \). The positive coefficients for DCORE indicate that Economics courses which satisfy a component of the Bridgewater State Core Curriculum are in higher demand. The null is also rejected for \( H_6 \) because of the non-zero coefficients for DMAJOR.

When taken as a whole, the various models suggest that if left to the information freely and readily available from the institution, students will develop strategies predicated on this information.

The array of nulls is rejected, and along with the persistent statistical significance of the dummy variables, we see how institutional information is closely tied to course enrollment. While correlation is not causation, the models seem to suggest that
data from internal information sources is extremely important in undergraduate course selection, which only further stresses the importance of the institution’s role in student strategy formulation and enrollment decisions.

**Additional Commentary on Regression Results**

Students in the business school are required to take a set of introductory Economics classes, specifically micro- and macroeconomics, as well as statistics. One would expect the number of business students to drive enrollment in these offerings. This draws our attention to Model 1, where a counter-intuitive relationship exists. Here, DCROSSLIST is statistically significant, but the size of the College of Business is not. One would expect that as the College has grown, so too would demand in these cross-listed classes, but neither ECONENROLLED nor BUSENROLLED were statistically significant in any model in which they were included. Model 1 suggests that external information sources are more responsible for the variability of course enrollment numbers. A dataset with semester-by-semester enrollment values for majors rather than yearly would likely improve the relationship and result in statistical significance.

Models 1, 2 and 3 also call attention to the desirability of web and hybrid courses. Two distinct models show that DHYBRIDWEB having positive coefficients and statistical significance. This has clear policy implications: students are demanding web and web hybrid courses higher rates than traditional lecture settings.

Another important relationship exists between a course’s
core attribute and enrollment numbers. Recall the definition of DCORE: a value 1 indicates that a course meets a Core Curriculum requirement. From the regression results we see that students are demanding Economics courses that satisfy Core Curriculum requirements. Interestingly, these are the same classes many business majors are required to take — the two introductory micro- and macroeconomics classes as well as statistics. Unfortunately, these data do not incorporate total University enrollment, leading to the possibility that the larger pool of potential students is demanding these classes. This omission may also account for the relatively low R-squared values seen across the various models.

An analysis of DCORE leads naturally to an investigation into the effects of the DUPPER, the upper- or lower-division dummy variable. DUPPER was statistically significant in three separate models. One might expect ECONENROLLED to adopt some of this relationship in Model 5, but interestingly ECONENROLLED was not found to be statistically significant, even with fewer regressors in play. The population of students demanding junior- and senior-level Economics classes is far smaller than the population that would demand freshman- and sophomore-level courses, so the results for DUPPER are somewhat intuitive. The relationship between DUPPER and PROPENROLLED also underscores the rational dynamics at work behind course selection and strategy development.

Note that DMAJOR is also statistically significant, but it is negative. Since DMAJOR represents whether a class satisfies an Economics major requirement, one would expect its effect on PROPENROLLED to be positive. Based on this result, it is
possible that the models are failing to control for some other independent variable. A potential remedy is outlined under Next Steps.

The statistically significant variable that presents the most problematic case against the status quo is RMPEASY. In Model 1, it is not only statistically significant, but has a relatively sizable coefficient when held against the institutionally-provided dummy variables. A professor’s perceived easiness accounted for six percent of the variability in class enrollment. A recent investigation from the University of California at Berkeley suggests that online ratings by students and internal institutional evaluations of faculty are fairly consistent with one another (Tipoe, 2013), and that the informal evaluations are rarely retaliatory or grade-related. Tipoe’s work speaks to the logical validity of predicating course selection strategy on external information sources.

The implication for this study is the realization that students are not only using a synthesis of internal and external information, but that they assign varying degrees of credibility to different pieces of information, even if that information comes from the same source (hence the significance of RMPEASY but not RMPOVRALL). This underscores a central problem in information economics: information is easily created but difficult to verify and act reliably upon. Consider that this paper only investigates two data points from one external source. When the individual considers an array of external information sources of varying quality, it is ultimately next to impossible for the student to derive an optimal strategy or ideal enrollment outcome.
Conclusions and Next Steps

The models above have a few noteworthy limitations, further encouraging the pursuit of future research into the area of undergraduate course selection, particularly as an analogue for microeconomic strategy formulation and the maximization of societal utility.

Most notably, the low R-squared suggests there are additional forces at work when students select undergraduate classes. Two notable omissions in this model include the total undergraduate enrollment numbers as well as course location. While the former may contribute considerably to the variation in enrollment, the time at which a course is offered is a critical component in terms of consumer choice. While it’s true that each has the potential to significantly increase the explanatory power of the model, additional regressors carry with them the risk of misrepresenting the significance of existing variables. Future projects should investigate the effects of competing demands for students’ time, notably standing professional, familial, or personal obligations.

Another noteworthy omission within the model is its inability to account for the comments section of RateMyProfessors.com. This is qualitative data, and would be impossible to accurately quantify without making outrageous and likely inconsistent assumptions. The problem with this omission is that students evaluating professors on RateMyProfessors.com are able to provide comments, which despite the quantitative scale ranging from zero to five, may dramatically impact a user’s interpretation of the professor’s desirability. Consider the case
where a professor is given an overall rating of 5 and an easiness rating of 2. The comments section of the website may include details about assignments, lecture style, the frequency of tests, or worse, ad hominem attacks. As a consequence, the quantitative component of this study may not fully capture the effect that the ratings have on professorial desirability (Baldwin & Blatner, 2003).

A final problematic result is the negative coefficients for DMAJOR. One proposed solution would incorporate a new variable that quantifies how many sections of a given course are offered each semester, rather than list every offering individually. To be executed appropriately, future research should consider all the various permutations that the five dummy variables can take on, and determine how many sections with those attributes are offered. When organizing and evaluating the data in this method, one would expect the coefficient to become positive while DMAJOR remains highly statistically significant.

It has been shown, however, that students rely on external information sources when deciding on courses, which should have ramifications on institutional academic advising processes. Clearly, there is an information gap between buyers and sellers of education, and it is incumbent upon the university to ameliorate this imbalance.

Other conclusions arise from the statistical significance of the various dummy variables. Because students are obligated to attend courses that satisfy certain Core Curriculum requirements, it is again incumbent upon the school to ensure such offerings exist in satisfactory quantities. The data also indicates that the Economics program (and overall enrollment in
the College of Business) is growing. To that end, it is critical that the school looks to align the supply of courses (and seats within said courses) with growing demand. Furthermore, the absence of class location data within the Infobear registration system creates confusion, barring students from incorporating location preference into their course selection strategy.

If future research is able to account for this missing information, or somehow quantify the comments section of RateMyProfessors.com, one might find a significantly higher R-squared in future iterations of this model.
Involuntary Equilibrium and Proposed Policy Action

The regression analysis confirms what the field of economics has demonstrated repeatedly over the years: that a variety of consumer tastes and preferences factor into course selection. The low R-squared of the regression model indicates that there are still more preferences that have not been captured in this particular study. Nonetheless, enough data exists to demonstrate the economic imperatives from which the notion of involuntary equilibrium is derived.

It has also been shown through the investigations in previous sections that the state of Nash equilibrium leaves every participant in the \( n \)-person game with a mixed bag of courses. This mixed bag yields a certain amount of utility, but in an amount significantly less than the maximum potential utility. Another significant observation is that individual utility derived from such a system will never equal the utility derived by another student, thus the system is not only inherently unfair, it is grossly inefficient.

The regression analysis also demonstrated that students do in fact rely on external information sources when selecting classes. While the econometric model does not (and in fact cannot) capture all influences of external information on consumer choice, it can (and does) inform development of an institutional structure inspired by models of a planned economy.

Finally, the econometric model, by its very nature, illustrates there are a finite number of options available to students in a
given semester. For economic purposes, we can treat the various combinations of courses as a Pareto frontier. This too should inform the development of any administrative or institutional model whereby the Pareto frontier is shifted outward, reflecting increased utility across the system.

**Systemic Modifications in the Short Run**

As touched upon in Section IV, one glaring deficiency in the existing Bridgewater State University system is a course registration system, Infobear, which does not provide class location information to students prior to course selection. This is an artifact of an administrative system that does not assign classrooms to courses until registration has been completed. While the impetus behind this policy decision may be noble (having to do with disabled access to certain facilities, for example), it serves as a barrier that prevents the typical student from making a more fully informed choice. The consequence of this missing information is a significant source of disutility not only for students, but also for the surrounding community as throngs of students move from building to building during passing time. Bridgewater State’s traffic issues are well documented (Carboneau, 2013), but from an economic standpoint, an ill-informed student cannot possibly develop a schedule that maximizes utility.

Another problematic policy is that of prioritized registration, as it represents an example of the "Matthew effect", also known as "the rich get richer and the poor get poorer" (Gladwell, 2011). In the current system, those students who have
completed more courses are allowed to register before those who have made less progress. Additionally, certain Honors students and student athletes are given priority registration. There is a considerable amount of anecdotal evidence suggesting that underclassmen are unable to make satisfactory academic progress because pre-requisite, core, or lower-division classes are full or otherwise unavailable by the time it is their turn to register.

Mathematically, progress towards graduation can be treated as a Hamiltonian path problem (Bellman, 1962), an analysis of which would make for compelling further research. Still, an institution’s continued commitment to prioritized registration complicates the issue of what the school considers “adequate academic progress,” and ultimately drives down both four- and six-year graduation rates.

Systemic Modifications in the Long Run

This analysis has worked to demonstrate that Bridgewater State University treats course offering and student registration from the supply side. Macroeconomic policy analysis has demonstrated that this is not necessarily the best approach to optimizing utility in such complex systems as undergraduate course registration (Krugman, 1995).

Effectively, what the University does is provide a supply of courses, provide advising resources of questionable consistency and reliability, and expect student demand for said courses to accommodate what is being provided. From its inception, this paper has worked to illustrate that the system is far more complicated, and that additional steps can be taken to maximize
overall utility within the system.

By starting with concrete data regarding student’s academic objectives (gathered from the students themselves), an institution can adjust supply to better align it with demand. Theoretically, a system designed in such a way can ensure that every consumer gets exactly what they want. This is the simplicity of a planned economic environment, and the implications of such a system are as profound as they are elegant. By considering consumer preferences in aggregate, an institution can ensure that realized consumer utility equals (or very nearly equals) potential utility. In macroeconomic terms such a structure would be analogous to a central government taking policy action to ensure that real GDP equals potential GDP. This is not a foreign ideal in American culture — it is a cornerstone of fiscal and monetary policy in the United States.

Conclusion and Author’s Notes

Critics will certainly suggest that this paper takes a dismal view of college students as intrinsically dim-witted or otherwise incapable. To the contrary — I acknowledge that college students represent the upper quartile of academic attainment in the United States. As a population, however, undergraduates are not tremendously skilled at decision-making, optimization, or evaluation of external information.

Detractors will certainly note that involuntary equilibrium requires an administrative framework verging on the impractical. Furthermore, as one administrator pointed out, “doesn’t this take all the fun out of college?” While an institution pro-
viding planned, rigid, degree programs would certainly require more manpower, more robust planning tools, and various methods to analyze consumer demand on an ongoing basis, the economic potential for systematic improvement is impossible to overlook. The purpose of this paper was to analyze weaknesses within the system and derive policy recommendations from that analysis. To that end, this analysis simply does not support the existing “free-for-all” environment.

This is the crux of the undergrad’s dilemma. Does a student continue to own the process of course enrollment and risk a less than ideal slate of courses every semester, or do they allow the institution to step in and assign them to certain classes? When coupled with an analysis of game theory and information economics, the data does not suggest the existing system of self-enrollment is the ideal method for delivering consistently optimized outcomes.

That said, the evidence speaks for itself. According to the White House’s Higher Education Scorecard, Bridgewater State has a six year graduate rate presently hovering just over 50 percent (WhiteHouse.gov, 2013). How can we justify the status quo when nearly one out of every two students cannot or does not finish a degree within six years? While students face a variety of competing demands for their time (family, work, and social pressures, etc.), this study has demonstrated the course selection and registration system — the gateway to degree completion — is rife with inefficiency and a source of massive disutility.

Author and Chronicle of Higher Education editor Jeff Selingo rightly points out that since World War II, education has held the promise of being the great American equalizer, eliminat-
ing social strata while engendering individual and societal well-being (Selingo, 2013). The community and the Commonwealth are entitled to a higher education system that is more carefully designed and administered, with the specific aim of ensuring student success.
Bibliography


BIBLIOGRAPHY


Afterword

The Editorial Board

Yazid Alfata

Yazid Alfata is a senior political science and economics double major at the University of Massachusetts Amherst. His academic interests include political and economic development in post-conflict societies, as well as theories of political economy. In the past, Yaz has worked in organizations like the Human Rights Watch and MERCY Malaysia. Following a gap year after his graduation, Yaz plans to pursue graduate studies in political science concentrating in political theory.

Jonathan Berke

Jonathan Berke is a graduating senior studying economics, psychology, and math. He co-founded the journal in 2012, and as an inaugural editor Jonathan helped oversee both the journal’s
initial growth and continuity. He will be attending the Economics PhD program at the University of Washington next fall to study topics in labor economics and public policy.

**Marton Gal**

Marton Gal is a rising junior studying economics and math. He is interested in macroeconomics and economic history, as well as anthropology.

**Samuel Jordan**

Sam Jordan is a graduating senior in the Department of Economics at UMass. While at school his studies included both a major in economics and a minor in computer science. He is the 2014 recipient of the department of economics Alumni Award for Distinguished Service. He served as Co-Governor of the Undergraduate Economics Club for the past year, and is a founding editor of this journal. Sam is interested in using analytics to improve efficiency and transparency, and to optimize systems, and has accepted a position to continue this work as a management consultant after graduation. He is grateful to have had the opportunity to work on this project since its founding.

**Parham Yousef Gorji**

Parham Yousef Gorji, native of Tehran, Iran, brings an international perspective to the issues in our selections. At the University of Massachusetts, Amherst, Parham is a double major in
Economics and Political Science. In his spare time he competes in Brazilian Jiu-Jitsu tournaments and is an aspiring photographer.

The Publication Working Group

Alex Major

Alex Major is the 2013-14 Submissions Liaison, after working on the Publication Working Group in the first issue. He is a class of 2014 senior studying economics and mathematics, and a member of the Board of Governors of the Undergraduate Economics Club. He is interested in corporate governance, the history of economic thought, and complex systems, and institutional memory is important to him. After graduation he will return to live in the Boston area – but after a few years in Amherst he likes the western part of the state better.

Aaron Goslee

Aaron W. Goslee is a current undergraduate Economics major, with minors in Mathematics and Chinese. In the next year, as a requirement for departmental honors, he will complete a thesis analyzing policies that address mineral-driven conflict and illicit financial flows in the Democratic Republic of Congo. His research interests include economic development and macroeconomics and monetary economics.
The Reading Group

Thanks for the invaluable assistance of these members of the Reading Group, without whose contributions the journal would have been impossible:

Julia Burgess
Kevin Curley
Garrett Drezja
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Brandon Sneider
Jonathan Sokolowski
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