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ECONPress is a publication for undergraduate compositions in economics. We publish twice a year during each fall and spring semester. ECONPress invites the highest quality submissions from undergraduate students in various economics related disciplines. It provides a forum for the undergraduate economics community to engage in active discussion and debate about the topics, theories, and applications they've learned in the classroom.

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Letter from the Editors

In the three editions that ECONPress has published since its inception, the undergraduate economic research community has begun to feel the effects of what we have accomplished. Authors see it as confirmation that the work they are conducting is relevant, interesting, and expanding the boundaries of knowledge of the economic discipline. Readers use the text to gain valuable insight into new and interesting aspects of research that they may have not encountered before.

Reviews and members of the staff here at ECONPress can't help but be glad to see that our mission of providing a forum for undergraduates to exhibit their work and to provide a platform for debate and discussion about the topics and theories of the not-so-dismal science. Nonetheless, we know that what we have done so far is a small glimpse at what we hope to achieve - to become the central and authoritative resource for undergraduate work in the discipline. For this reason we have continually sought to improve how we do things.

In the past year, ECONPress has undergone significant changes to its refereeing process to facilitate us in our goal of working directly with the authors to improve the experience of both authors and reviewers during the selection process. This process will continue as we refine and update the process to accommodate feedback.

We can only grow in conjunction with you - so continue to discuss, debate, and argue. Formulate hypotheses and test them with the methods you learn, question the conclusions and then ultimately share your results so that we too may build upon your hard work. It is this process by which we mean to say "rethink your world" - and by doing so, help us to do the same.

Thank you for taking part,

<i>Alec Loudenback</i>	<i>Victor Martinelli</i>
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The Editorial Board of ECONPress

The Stanford Markets for Managers: A Natural Experiment in Market Design

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Stanford University

Abstract

At Stanford University students manage the undergraduate residential neighborhood on Mayfield Avenue, known as “the Row.” Every year the Residential Education office matches from 150 – 300 students who apply to work in these houses as managers or residential assistants (RAs). The Stanford market for managers matched students under priority-matching until 2010, while the market for RAs matched under deferred acceptance (DA). These different algorithms allow for a natural experiment in market design. Inspired by Roth (1990), I have compared students’ behavior in these markets to argue that unstable algorithms (priority-matching) are more prone to unraveling than stable algorithms (DA), as individuals have an incentive to pre-arrange matches outside the market. Section 1 describes the Stanford markets, while Section 2 compares these markets to markets for medical students in the UK. Section 3 reports my results. Finally, section 4 concludes with some limitations of the DA algorithm.

Introduction: The Stanford Market for RAs and Managers¹

Stanford enjoys a unique Residential Education system known as “the Row.” The Row is a set of 35 houses located on Mayfield Ave. These houses are regarded as the premier undergraduate (undergrad) residences at Stanford (Nam and Kumar, 2010).² Varying widely in size, layout, and room configuration, the Row houses accommodate roughly 1,600 students per year. These houses tend to have strong dorm cultures, some of which revolve around national themes – such as the European-themed houses, *Casa Italiana* and *La Maison Française* – while others embrace alternative lifestyles – such as Synergy.

Nonetheless, different from regular dormitories, all the Row houses are managed by students. These houses fall into three management models: self-operated houses, co-operated houses, and Greek houses. In the 20 self-operated houses (self-ops)³ students manage cleaning services and hire professional kitchen staff. In the 7 co-operated (co-ops) houses, students themselves undertake the full spectrum of house activities, from cooking to cleaning. Greek houses (fraternities and sororities), like self-ops, hire cleaning services and kitchen staff. However, these houses screen all their residents through the annual rush process. Therefore, Greek houses are re-

¹ I would like to thank Stanford Residential Education officials Cisco Barron, Sergio Hernandez, and Zac Sargent for their help and interest in this project.

² During an interview with a housing specialist I serendipitously met with Alice Nam, a Stanford undergraduate who had written a paper about the Stanford Market for Managers on 2010. Her findings are important to the conclusions in this study.

³ This includes the residence on 1035 campus drive, which was converted from a Greek house into a self-operated house in the 2010-2011 academic year.

Table 1. House Preferences

KM	FM	CM	RCC	RA
Candidate A	Candidate B	Candidate C	Candidate D	Candidate C
Candidate D	Candidate A		Candidate T	Candidate B
Candidate E			Candidate Z	Candidate X
				Candidate G
				Candidate H

Table 1 is an example of how a house’s preferences might look like. Note that the residence can list the same candidate under different jobs. For instance, Candidate A is the house’s first choice of Kitchen Manager and, at the same time, the second choice as Financial Manager.

Table 2. Candidate Preferences, Example

Position	House
House A	CM
House A	KM
House B	CM
House A	FM
House C	FM

Table 2 is an example of how a candidate’s preferences might look like. Note that the candidate prefers to work as Community Manager in House A to working as Kitchen Manager in the same house. But she also prefers working as a CM in House B to working as FM in House A. This table was adapted from Kumar and Nam (2010).

stricted to members of each organization (Student Housing, accessed on May, 2011).

Collectively, row managers move an estimated \$5 million annum⁴ to pay custodians, chefs, feed residents, organize social events, and maintain the houses. Each house counts on at least four managers and one resident assistant. The Financial

⁴ This is a rough estimation, obtained by taking the “GNP” of *Casa Italiana* and multiplying it by the total number of houses.

Manager (FM) is responsible for tracking, setting, running, and reporting the house budget. The Community Manager (CM) is responsible for organizing social events and serves as the primary liaison between students and the Stanford Housing Facilities and Services department. The Kitchen Manager (KM) is responsible for supervising the professional kitchen staff, ordering food, assisting with menu planning, and setting a food budget.⁵ The Resident Com-

⁵ A complete description of the

puter Consultant (RCC) assists students with computer-related problems and maintains the house's wireless network (Stanford University Residential Education, accessed on May 2011). Finally, the Resident Assistant (RA) has the more traditional role of acting as student leader and counselor. RAs can be found not only in the Row houses, but also in regular dorms.

In order to become a manager, students go through a 3-week application process supervised by Residential Education. First, candidates express their interest in specific houses through an online application. Second, houses offer a round of interviews to a subset of these candidates.⁶ Third, after interviews both applicants and houses rank their preferences on each other and submit this list to a "clearinghouse," the Residential Education Office, which matches students to positions in houses.

The current student staff determines the house's preferences. Houses may rank up to 8 candidates for each position, while candidates may list up to 10 positions for jobs in houses. Houses may list the same candidate for different positions (Kumar & Nam, 2010). Table 1 is an example of how a house's preferences might look like. Similarly, candidates might list different positions in the same house. Table 2 is an example of how a candidate's preferences might look.

Natural Experiments in Market Design: An Argument for Stable Algorithms

In this section I compare the match-

ing algorithms used in markets for medical students in the UK to the ones adopted by Stanford. Both Stanford and medical markets in Britain have relied on stable and unstable algorithms. Moreover, priority-matching in both places has been associated with similar patterns of market unraveling. Under priority-matching, individuals prefer to contract outside the central market to enter the formal matching process.

According to Kumar and Nam (2010) until 2010 the Stanford Residential Education Office matched managers using a product-based, priority-matching algorithm. More specifically, if a house and a student each ranked one another first (a 1-1 match), they had priority 1 in the matching. If the house ranked the student first, but the student ranked the house second (a 1-2 to match), they had priority of 2. If a house ranked the student second, but the student ranked the house first (2-1), they also had priority of 2. Accordingly, the office would match all the 1-1 preferences, followed by 1-2, 2-1, 1-3, 3-1, 2-2, 1-4, 4-1, and so forth⁷ (Kumar and Nam, 2010). Resident Assistants (RAs), on the other hand, are matched under Gale and Shapley's Deferred Acceptance (DA) algorithm. Deferred Acceptance can be described as follows: (1) all houses make an offer to their first-choice candidates; (2) candidates hold on to their favorite offer, rejecting all others; (3) the rejected houses make a new offer to their next favorite acceptable candidate that has not rejected them; (4) candidates hold their favorite acceptable offers from all previous rounds, rejecting all others houses. The DA algorithm repeats the third and fourth steps until all candidates are matched⁸ (Featherstone, & Mayefsky,

$\left(\begin{array}{l} \text{House}^A : C_A, \dots \\ \text{House}^B : C_A, C_C, C_D, C_E, C_F \\ \text{House}^C : C_C, C_D, \dots \\ \text{House}^D : C_D, C_C, \dots \\ \text{House}^E : C_A, C_B, C_E, C_C, C_D, C_F \\ \text{House}^F : C_D, C_E, \dots \end{array} \right)$	$\left(\begin{array}{l} \text{Candidate}^A : H_A, \dots \\ \text{Candidate}^B : H_B, H_A, H_C, H_D, H_F, H_E \\ \text{Candidate}^C : H_D, H_C, \dots \\ \text{Candidate}^D : H_C, H_D, H_E, H_B, \dots \\ \text{Candidate}^E : H_A, H_B, H_E, H_C, H_D, H_F \\ \text{Candidate}^F : H_E, H_B, \dots \end{array} \right)$
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Figure 1. An example of the preferences of a theoretical set of houses and candidates.

2010). This algorithm can be extended to allow each house to have multiple managers (Roth & Sotomayor, 1990).

The exquisite work of Alvin Roth (1990, 1991) compared medical markets in the UK, supporting the DA algorithm over priority matching. Medical graduates in the United Kingdom seek pre-registration positions comparable to US medical residencies. In order to obtain full registration as doctors, medical school graduates must work in medical and surgical pre-registration positions. Clearinghouses in Britain take into account individuals' preferences to match medical students to consultants (supervising physicians and surgeons) such that no consultant is assigned more students than he has positions.

Medical markets in the UK can be compared to the Stanford markets for RAs and managers. These markets have the same approximate size. The British medical markets matched from 100 to 300 positions (Roth, 1990); Stanford matched 238 managerial positions in 2010, and 184 RAs in 2011. Moreover, the British markets followed the same logic as Stanford. The markets in Newcastle and Birmingham matched students to consultants under the same

product-based, priority-matching rule used in the Stanford market for managers pre-2010. Similar to Stanford, Birmingham broke ties in favor of consultants. Newcastle broke ties in favor of students (Roth, 1991).⁹ The medical markets of Cardiff and Edinburgh (post-1969), on the other hand, adopted Gale and Shapley's DA algorithm used in the Stanford market for RAs.

Priority-matching algorithms exhibit an important disadvantage compared to DA, namely priority-matching might yield unstable matches. An assignment is unstable if there is a pair of candidates A and B who are assigned to positions in houses (or hospitals) A and B, respectively, although candidate A would prefer house (hospital) B and candidate B would prefer house (hospital) A¹⁰ (Gale and Shap-

responsibilities of each position can be found at <http://studentaffairs.stanford.edu/resed/studentstaffjobs/managers>.

⁶ This information is available at <http://studentaffairs.stanford.edu/resed/news/2011managersselection>

⁷ Note that there is some level of arbitrariness in this order. Why should 2-2 come before 1-4? Why should ties be broken in favor of houses? Such particularities do not matter for the overall argument against priority matching.

⁸ If one thinks about this procedure

⁹ Other two regions, Edinburgh and Sheffield, also adopted the similar priority-matching mechanism. But these two regions favored the consultants to a greater extent. That is they would match 1-1 matches first, followed by 1-2, 1-3, 1-4, and so forth. Other matches were considered only after all the consultants' first choices had been exhausted (See Roth, 1991 for details).

¹⁰ An assignment may also be called unstable if it contains unacceptable matches. A student is unacceptable to a house if the house prefers to keep the position vacant rather than fill it with that student. A house is unacceptable to a student if the student prefers to remain unmatched to accepting a

for long enough, it becomes clear that the matching will terminate in no more than n rounds, where n is the number of houses and candidates (Levin, 2011).

ley, 1962). This result can be interpreted in the following manner: candidates may prefer circumventing the market by trading informally among themselves, instead of formally entering the matching system (Levin, Lecture 1; Roth, 1990). To see this implication, consider the following example adapted from Roth (1991). Consider six students and six houses. For simplicity, assume the houses are looking to fill one position (Financial Manager, for instance) and that each student would like to work in this position.¹¹ The preferences for houses and students are listed in Figure 1.

Where C_A indicates Candidate A and H_A indicates House A. Note that this set of preferences is reasonable as houses tend to prefer the most promising managers (Candidates A through F) and students tend to prefer the most desirable houses (Houses A through F). At the same time, individuals have idiosyncratic preferences in their orders. The priority-matching mechanism would yield the following matches in this example:

$H_A C_A (1-1)$, $H_C C_D (2-1)$, $H_B C_C (2-1)$,
 $H_D C_B (3-1)$, $H_F C_F (6-1)$, and $H_E C_E (2-6)$.

As a result, House E is disappointed to learn that they were assigned Candidate F as their Financial Manager. Furthermore, House E would have preferred Candidate E to the final assignment and Candidate E would also have preferred this house to his final assignment in House F.

Once individuals realize this instability, what should they do? Mindful of the experiences in previous years, houses might approach students before the match day. Arguably, House E would approach Candidate E and simply offer him the FM position.

job in that house (Roth, 1990).

¹¹ While this simplifying assumption makes the argument clear, the example and implications that follow do not depend upon this simplification.

Even if candidates and houses are formally coerced into submitting their preferences to a central market, participants can pre-arrange before the match day by agreeing to rank each other first. Note that the Candidate E is not House E's first choice (and vice-versa), but they fare better in the market if they pre-arrange. Under priority-matching, individuals have a strong incentive to contract outside the market as they can *guarantee* a match by ranking each other first.

These pre-arranged deals harm individuals who participate truthfully in the market, reinforcing the incentives to lie about preferences. To see this, suppose Houses C, D, and E offer to rank students A, B, and C first if they reciprocate the favor. Again, it is noteworthy that these houses are not the students' first choices. However, students might prefer to accept deals from good enough houses rather than truthfully entering the market and risk being dragged down the list (like student E in the example above). Now suppose that, naively, House B and Candidate D participate in the market truthfully and submit their preferences ($C_A, C_C, C_B, C_D, C_E, C_F$ and $H_C, H_D, H_E, H_B, \dots$). Unbeknownst to the house, Candidate D is the best candidate available. Similarly, House B is the best available house to the candidate. As the product of these rankings is 16, it is not hard to see that these participants will probably be disappointed with their final match. In a lab experiment where individuals were matched according to priority-ranking, Featherstone and Mayefsky (2010) showed that people eventually realize that telling the truth is not a best response. I argue that most students at Stanford have also learned this.

These predictions have been confirmed in Roth's study (1991) of regional markets for physicians and surgeons in the UK. In Newcastle, which relied on priority-matching, in up to 80% of rankings students and consultants only indicated their first prefer-

ences, suggesting that the match had been pre-arranged. Similarly, Student Affairs Specialist Sergio Hernandez observed that in past years a large percentage of candidates in the Stanford market for managers only ranked a single preference (personal communication, May, 2011). Nam and Kumar (2010) found that out of the 156 matches in 2010, 80.6% were 1-1. Furthermore, 35.7% of the candidates had only listed a single choice. Hernandez recognized that this behavior reflects pre-arranged deals.

Nam and Kumar (2010), having participated in the market for managers at Stanford, report personally witnessing a few of these pre-arranged deals. Specifically, four days before the preference deadline, one of the authors received the following e-mail: "You were definitely our favorite RCC candidate, so if you want to rank (name of the house) RCC first I can guarantee that you'll get the job" (See Nam and Kumar, 2010 for more examples). Similarly, I personally recall witnessing several such interactions before the match day. In one particular instance, a candidate offered to exchange information about our first choices during his job interview with our house.

As individuals seek pre-arranged deals outside the market, the matching mechanism loses purpose and eventually collapses. Consequently, unstable algorithms are more prone to failure than stable ones. Newcastle abandoned its scheme in 1981. Birmingham restarted its program twice (in 1971 and 1978) before finally abandoning priority matching in 1981. The administrations of Newcastle and Birmingham explained that these markets failed as candidates and senior physicians preferred to contract outside the market (as cited in Roth, 1991). The markets in Edinburgh and Sheffield also collapsed under priority-matching. In fact, only two out of the six British markets that relied on unstable matches studied by Roth (1990) survived until the 1990s. These are the London Hospital and Cambridge markets. It is noteworthy that these

were the only two markets that adopted procedures in which a student and consultant who ranked one another first would *not* necessarily be matched together.¹² In other words, pre-arranged deals were not certain. On the other hand, markets that have adopted stable algorithms such as Gale and Shapley's Deferred Acceptance (DA) algorithm (1962) have thrived. Roth suggests that the success of the American National Resident Matching Program (NRMP), for instance, is due to the stability of its matching algorithm. All the stable markets in Roth's study have survived until the 1990s. These markets are the NRMP, Cardiff, and Edinburgh, which switched from priority-matching to Gale and Shapley's DA algorithm in 1969. Similarly the Stanford market for managers switched from priority-matching to DA in 2010.

Results in The Stanford Markets

In his seminal study, Alvin Roth (1990, 1991) compared stable and unstable markets in England to support stable algorithms (like DA) over unstable algorithms (like priority-matching). Different regions in the UK opted for different algorithms, creating a natural experiment in market design. Stanford allows for an analogous experiment. Residential Education matches RAs under Gale and Shapley's Deferred Acceptance (DA) algorithm (RA Matching Manual, 2010; Barron, personal communication, May, 2011). However, all other managers (CMs, FMs, KMs, and RCCs) were matched under priority-matching until 2010, when this market switched to

¹² According to Roth (1990), these markets quite particular since they were the two smallest markets in the sample. The author argues that participants in these markets may be effectively compelled by social pressures to comply with match procedures (See for a more detailed presentation see Roth 1990).

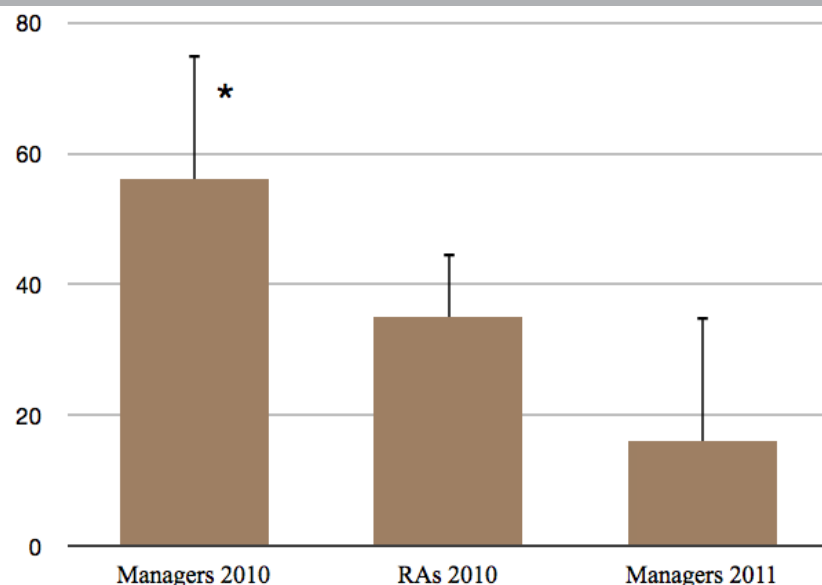


Figure 2. The number of candidates who listed a single choice.

DA (Kumar and Nam, 2010). This section compares the behavior of students in three conditions: (1) the market for RAs, (2) the market for managers pre-2010, and (3) the market for managers post-2010. I have approached the Director in Residential Education Central Operations, Cisco Barron, and offered to analyze the data on the Stanford markets. I was able to obtain data managers' preferences in 2011 (after the transition to DA), and RAs' preferences in 2010. I compare these data to managers' preferences in 2010 (from Kumar & Nam, 2010). I hypothesize that a greater number of candidates will list a single choice if matches are unstable, reflecting market unraveling as observed in Newcastle (Roth, 1990).

In 2010, 248 students applied for 158 managerial positions. As previously mentioned, of these 156 matches, 35.7% (56 candidates) listed a single choice.¹³ This

high percentage suggests that the market for managers had unraveled in 2010. In 2011, 155 candidates applied for managerial positions. This smaller number might be a consequence of Residential Education moving the interview process to earlier in the quarter. Of these candidates only 10% (16 candidates) listed only one choice. This reduction is significant ($p\text{-value} = 0.018$), suggesting that the transition to a stable algorithm has reduced the number of pre-arranged deals in this market.¹⁴ Finally, 224 candidates applied for RA positions in 2010. In this market, only 16% of the candidates (35) listed only one choice. As expected, this number is also significantly lower than the percentage reported by Ku-

excluded these candidates from the analysis, for the number of total matches is 237. Nonetheless, the authors are not explicit about their procedure. In addition, there are about 13 specialized positions that I do not take into account in this study such as co-op managers and peer health educators (PHEs).

¹⁴ Unfortunately, Kumar and Nam (2010) do not report the standard error of the distribution. Therefore, in lieu of a better estimate, I have assumed standard errors in 2010 were similar to the ones in 2011 in the market for managers.

¹³ I assume that Kumar and Nam (2010) do not include matches in Greek houses in this percentage as Greeks are chosen within their organizations. Their rankings are a mere formality. The data obtained from the Row Office suggests that indeed Kumar and Nam

mar and Nam in 2010, but not statistically different from the market for managers in 2011 ($p\text{-value} = 0.2$). The market for RAs and the market for managers post-2010 are also similar in the average number of choices listed per participant. In 2011 managers listed an average of 7 choices. These results, depicted in Figure 2, suggest that stable markets show less signs of unraveling.

In summary, there were fewer single choices listed in the market for RAs, compared to the market for managers in 2010. Furthermore, after the market for managers adopted DA in 2011, the number of side deals presumably decreased from 35.7% to 16%; this last percentage is statistically equivalent to the one observed in the market for RAs. These results, represented in Figure 1, suggest that the transition from priority-matching to DA has reduced the degree of market unraveling at Stanford.

Limitations to Deferred Acceptance and Concluding Remarks

My results reinforce a common theme in market design: stable algorithms seem preferable to those that are unstable. It is nonetheless important to recognize the limitations of Deferred Acceptance. This section concludes my study by discussing two limitations of the DA algorithm. First, truth-telling is not a dominant strategy for the candidates. Second, in order to guarantee stability we must make the unrealistic assumption that students are substitutes rather than complements.

Under DA, houses have no incentive to engage in strategic behavior; however, students might still have an incentive to truncate their preferences. Dubins and Freedman (1981, as cited in Levin, 2010) have proved that reporting true preferences is a dominant strategy to the proposing side of the DA algorithm. As a result, houses should not be persuaded to seek pre-arranged deals

with candidates. However, truth-telling is not a dominant strategy for students. To see why, consider the following example: two Houses A and B, and two candidates A and B. House A prefers Candidate A, and House B prefers Candidate B, but the candidates have the opposite preferences. The DA algorithm will yield the following matches (*House A, Candidate A*) and (*House B, Candidate B*). Now suppose that these candidates lie, listing their least preferred houses as unacceptable. This will lead both houses to propose to their second choices. As a result, the final match will be (*House A, Candidate B*) and (*House B, Candidate A*), leaving both candidates better off¹⁵. This trade-off is a general property of matching algorithms. In a two-sided matching market, it is impossible to create a mechanism that is both strategy-proof and always results in stable matches (Roth, 1982).

Nonetheless, I argue that in practice students are unlikely to learn how to profitably truncate preferences. In perfect information settings, participants who are mathematically minded might learn how to profitably lie about their preferences. However, in more realistic environments (where information is incomplete and students do not know each others' preferences), deciding whether or not to declare a potential match as unacceptable quickly becomes complex. More explicitly, such a decision concerns whether to match to a low-ranked house with some probability, or to increase both the likelihood of obtaining a better house and of remaining unmatched (Cole, 2009 as cited in Featherstone and Mayefsky, 2010). I argue that it is unlikely that candidates will perform such a calculation. Accordingly, Featherstone and Mayefsky

¹⁵ This follows from the fact that the DA yields pessimal stable matches for students. This result is proved in Knuth (1967). If the candidate has at least one other stable match available, the candidate will be matched with this house and, therefore, be better off than if he had been truthful. See also Roth and Sotomayor (1990).

(2010) show that in a lab experiment, participants fail to learn how to profitably deviate under an incomplete information DA.¹⁶

A more concerning limitation is the mathematical simplification necessary to ensure stable matches in the DA algorithm. The key assumption in these deferred acceptance algorithms is that houses view students as “substitutes” rather than “complements” (Levin, 2010). This is an unrealistic assumption, as both sides of the market probably have preferences over sets of candidates. In the British medical markets, for instance, students prefer one medical and surgical position to any other combination (Roth 1990). Similarly, Stanford houses have preferences concerning their groups of managers and RAs. According to Cisco Barron, Director in Residential Education Central Operations, some houses have strict preferences about gender balance. In other cases preferences are much more idiosyncratic: some dormitories in the past, for instance, have requested a balance between “followers” and “leaders.” The mathematical assumptions in DA, however, disregard these complementarities. In other words, we assume that if a house were willing to hire a given student as part of some group, it would still want to hire him even if some other member of that group were to become unavailable. My personal experience selecting staff members does not support this assumption. At the time of this writing, the “complements” case is still the subject of active research (Levin, 2010).

In conclusion, centralized procedures have prevented markets from unraveling due to early contracting or exploding of-

fers. In addition, there is considerable evidence that stable procedures succeed more often than unstable procedures. Unstable algorithms, such as priority-matching, give participants incentives to circumvent the formal market.

Thus, these markets might fail to solve the problem that motivated their introduction.

Roth (1990) argues that preserving stability of the system is the first priority in a market design. The developments in the Stanford markets for RAs and managers have supported this important insight.



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¹⁶ In addition, candidates are probably risk-averse in these situations. Thus, It is unlikely that they will gamble their chances of receiving a position. It is also noteworthy that risk aversion might actually be one of the reasons why participants accept pre-arranged deals in priority-matching algorithms.

Labor Force Determinants of Foreign Direct Investment: Exploring the Labor Forces of Middle and High Income Countries

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Space for Abstract

Introduction

Globalization has changed the rules of the investment game (Nunnenkamp 2002). The traditional economic determinants of foreign direct investment (FDI) and the factors that attract FDI in a country have changed. In the past twenty years, market

liberalization in most countries, multilateral trade rounds and negotiations, and the availability of information and technology have shifted FDI decision makers' priorities. Research is finding that lower trade barriers have made tariffs a less relevant determinant of FDI and has made tariff-jumping FDI less prevalent, that a host country's labor costs and natural resources are also less relevant in export oriented FDI, and that more and more, through the advancement of transportation and communication, FDI can be moved from one host country to the next with minimal disruptions in the production process. These conditions were evident when Russian workers held a strike for higher wages in a Ford manufacturing plant in Russia. Ford simply began importing cars made in their German car factory into Russia. These conditions, especially the mobility of FDI, intensify the competition between potential host countries.

Because of this, the determinants of FDI changed in two significant ways:

1. Because of improvements in communication, information, finance, technology, and education, multinational Corporations now make FDI decisions based on a broader set of determinants and policies.
2. There is increased competition among countries because of these changes in the global market and countries are forced to find unique selling points to attract FDI.

After the 2007 financial crisis, the global investment landscape changed (UNCTAD 2009). Sudden shifts in investment decisions have made the determinants of FDI even more important. Especially among developing countries looking to promote economic growth, this shift in FDI flows provides an opportunity to attract FDI to help them pursue their development goals. These countries must find the right combination of characteristics foreign investors

find attractive.

Using FDI data from 2008 this paper employs Ordinary Least Squares (OLS) regression estimation to explore the determinants of FDI that investors consider when investing in a country. This paper specifically focuses on the labor market qualities that investors consider in locational FDI decisions. This paper is divided into five sections: Section 1 is a survey of current and recent research on the general determinants of FDI, the labor force qualities that determine FDI and the observed changes in these determinants. Section 2 is an explanation of the specifications of the regression model used in the research. Section 3 is a description of the variables in the model, their measures and their data sources. Section 4 is a presentation of the estimation results. Finally, section 5 presents the findings of the study. Further improvements to the study and possibilities for further research are suggested at the end of the paper.

Surveying Current Research: The Changing Determinants of FDI

Classical investment theory suggests that the determinants of FDI are based on market forces that consider real and potential costs. Traditionally, these considerations comprise primarily of wage rates and resource costs. With changes in technology, cost structures and the advancement of globalization, recent studies have found that these theories continue to hold with several slight modifications. The literature reviewed for this research cover two areas. First, recent research papers addressing the modern determinants of foreign direct investment are analyzed. Second, emphasis shifts to research addressing the labor market quality determinants of foreign direct investment.

Determinants of FDI

Joong-wan Cho (2004) provides an overview of the determinants FDI in his paper Foreign Direct Investment: Determinants, Trends in Flows and Promotion Policies. He posits that determinants of FDI can be categorized to three main groups: economic conditions, host country policies and multinational enterprises' (MNE) strategies (Cho 2004). Within each of these three groups are a host of variables that have individual effects in determining FDI. His presentation is of great use in trying to understand the many characteristics that influence investment decisions for multinationals.

Economic Conditions

Cho includes characteristics like market size, natural resources, stability and labor market qualities in the category of Economic Conditions. His analyses find support from many other authors and their results.

Marcelo Nonnemberg and Mario Medonca (2004) find that variables relating to macroeconomic performance like stability and economic growth are important determinants of FDI. They also find evidence, through the Granger causality test that a rise GDP leads to increased FDI whereas the reverse is often untrue. The OECD (2000) supports Nonnemberg and Medonca's findings. In a working paper exploring the determinants and impacts of FDI on China's economy, they find that China's rapid GDP growth plays an important role in attracting FDI. China's growth indicates a large potential market making investing in China a favorable decision. With China's population there is a vast potential for consumption. This, coupled with the economic reconstruction that began in the 1990s, continuously increases the population's purchasing power (Nonnemberg and Mendonca 2004).

Along with macroeconomic performance, Cho emphasizes the importance of economic stability in attracting FDI. As mentioned, Nonnemberg and Medonca finds this to be true. Although they find that macroeconomic stability, using inflation as a measure of stability, is an insignificant factor in FDI decisions, their research finds that risk, measured by the risk rating created by "Euromoney" has a highly significant negative relationship to FDI decisions. Because stability itself is an important determinant of risk, macroeconomic stability therefore, is also important. Supported by economic theory, this rationale supports Cho's proposition.

The UNCTAD World Investment Report 2009 findings also support Cho, Nonnemberg and Medonca with empirical observations. After the financial crisis and consequent recession of 2007, FDI flows in the world dropped precipitously. They estimated that from the first quarter of 2008 to the first quarter of 2009, world FDI flows dropped by 44% (UNCTAD 2009). Most of the 44% decline in world FDI took place among the developed countries. With their interconnected banking systems, perceived financial instabilities in the developed countries' macro-economies have deterred FDI inflows. In contrast, the UNCTAD report also finds that while developed countries' FDI flows experienced a decline, the FDI flows into developing countries were not so dramatically affected as their economies remained robust through the beginning of 2008. Compared to the developed countries, developing countries only posted a decline of 17% by 2009 (UNCTAD 2009).

Policy

Host country policies influence FDI decisions as well (Cho 2004). Among these policies, Cho mentions that access to foreign exchange, the repatriation of profits and the importation of raw material and technology are key policies in FDI decision making. Citing Asian economies' export

strategy, he says that trade policy also plays an important role.

Cho also mentions that countries also implement policies on what kind of foreign investment to attract. His findings indicate that host country FDI promotion policies are often made to attract the most FDI but rather attempt to maximize the positive effects of FDI and minimize its negative effects. Once again, Cho finds support among his colleagues Nonnemberg and Mendonca who find that the willingness of a country to accept FDI, using openness as a proxy variable for the country's willingness to accept FDI, increases the overall level of FDI in a country and found it to be highly significant in attracting FDI.

The OECD once again observes that through bilateral trade agreements and significant reductions in trade barriers in the 1990s, China's export promotion strategies boosted its inward FDI flows. This export promotion encouraged production oriented FDI into the country by easing export restrictions making it easier to include China as part of a final good's production process. Goods produced in China were inevitably exported to another country as part of the production process. As seen in China, easing export restrictions encourages FDI. The opposite is expected when import restrictions are lowered. Because FDI is not only production oriented (as in the case in China) but also sometimes market oriented (focusing on producing goods eventually sold in the same country) when import restrictions are lowered, market oriented FDI is expected to decline.

Among these policy strategies, Cho suggests that investment incentives and national investment promotion agencies play an important role in attracting FDI. Again, Cho finds support for this position. Dividing MNEs to large firms and small firms, Yuko Kinoshita (2001) finds that larger firms take policies like incentives, openness and business promotion strategies into

account when investing in a host country. Smaller MNEs however do not find these policies a significant consideration in FDI decisions, preferring to choose FDI locations based on more traditional cost based considerations like labor costs.

In sum, recent research indicates that policies play a large role in attracting FDI. Especially important are policies related to trade, openness, and ease of business. Although countries can regulate the types of FDI they receive, a generally attractive policy environment has a positive effect on the amount of FDI that enters the country. In attracting admitting FDI however, host countries are found to be more and more selective of these investments, ensuring that they maximize the benefits and minimize the costs of FDI.

MNE Strategies

The third category Cho identifies as a determinant influencing investment decisions is the strategies of MNEs themselves. Operating on risk perceptions and profit maximization, MNEs determine which countries are least costly, most profitable and most productive in their investment decisions. Cho mentions that although low costs, especially in labor, still influence investment decisions, considerations of a multitude of factors now heavily influence MNE investment decisions.

Kinoshita's analysis on the decisions of small and large MNCs confirms Cho's hypothesis. He finds that small firms look for cost reduction and infrastructure investments while larger firms seek to invest strategically and often in large markets.

As outlined by Cho, recent research finds that economic conditions, host country policies and MNC strategies considerations affect FDI decisions. Nonnemberg and Mendonca, Kinoshita, and the OECD have found empirical evidence supporting Cho's analyses. All of them find that these

variables play a significant role in influencing investment decisions and determining host country FDI.

Labor Market Qualities

Beyond the determinants listed above, considerable literature and research is also dedicated to analyzing a host country's labor force as a determinant of FDI. Cho categorizes labor force qualities under the precipice of economic conditions. He posits that labor availability, cost, skills and trainability all comprise what he considers as the competitiveness of the host country's economy. Again, several studies support his hypotheses.

Rashmah Ismail and Ishak Yusoff (2003) confirm Cho's hypotheses on labor market qualities in their study of FDI in Malaysia, Thailand and the Philippines, otherwise known as the ASEAN 3 countries. Although the ASEAN 3 depend on cheap labor to attract FDI, this comparative advantage slowly eroded to the lower labor costs of Bangladesh, India, China and Vietnam. Developing human capital, they posit, is the only way the ASEAN 3 can further attract FDI. Comparing them to opposite ends of the FDI spectrum in Asia, they find that labor costs play only a partial role in determining FDI. On one end are countries like Singapore and Korea that, even with substantial increases in labor costs, attract FDI because labor productivity remains high through high technology and skill intensive industries investments. On the other end of the spectrum, they identify China, a country whose very low labor costs with no increase in productivity, still manage to attract FDI. This dichotomous relationship indicates two types of FDI – high technology capital and research investments and low skill manufacturing investments.

They also find that ASEAN 3 countries have very different labor market needs in attracting FDI. A specific combination of

labor force attributes such as a sufficient supply of labor, skills, and labor costs are the most crucial factor determining FDI inflows in the host country (Ismail and Yussof 2003).

Although most of Ismail and Yussof's findings are supported by the literature, there is some debate on how much labor cost determines FDI. Noorbakhsh, Paloni and Yousseff (1999) disagree with the suggestion that labor costs play a small role in the amount of FDI a country receives. They find that although technological advancement and capital investments have reduced the need for labor, low skilled labor and the low costs associated with it are still important determinants of FDI. Although consider labor cost a more significant FDI determinant than many of their colleagues, they arrive at similar conclusions as Ismail and Yussof: that locational advantages consist of a competitive combination of high skill, low cost, and significant productivity levels (Noorbakhsh, Paloni and Yousseff 1999).

Noorbakhsh et al.'s study also finds specific locational characteristics that attract specific kinds of FDI. They explain that these characteristics explain why firms divide their production process to different countries with specializations in finance, research and development, or manufacturing. Just as Ismail and Yussof have concluded, Noorbakhsh et. al. find that the combination of skills and productivity are growing in importance in determining FDI. Developing this human capital over time through education ensures that the host country's economy attracts higher value added and higher technology FDI over time. Labor, they go on to say, is no longer a cost that needs to be minimized but rather, an investment, whose potential needs to be maximized.

Cho's thoroughness in identifying the labor market qualities that determine FDI is not perfect. Several other authors have

observed a different set of determinants of FDI flows. Eckel and Egger (2009) in particular, studied the relationship between the wage bargaining and multinational firms. They observe that the shifts in FDI movement are partly a result of wage bargaining and cost minimization in part of the MNC. When, for instance, Russian Ford factory workers decide to go on strike for higher wages, Ford decides to shift its production process to its German factory and import cars into Russia. Eckel and Egger observe that trade barriers and wage bargaining are very important aspects of FDI. They posit that MNEs often have options in considering lower costs to access a host country's market: MNE's could either bargain a lower wage rate or import products into the country. These options suggest that wage bargaining is not significant in attracting FDI if the overall importation costs are relatively low. On the other hand wage bargaining is more likely to occur if these costs of importation are relatively high.

The labor market does not only determine FDI. FDI also often cause shifts in demand in the labor market. Fajnzylber and Fernandes investigate the impacts of exports, imports and FDI on the labor markets of Brazil and China and find a dichotomous relationship. In Brazil, they observe that higher levels of exports, imports and FDI result in a shift in demand of labor to more skilled labor while the opposite is true in China.

In sum, the literature finds that a multitude of labor force characteristics are considered in FDI decisions. Costs are a less significant consideration now than it was before because of advancements in technology, information access, and education. Overall productivity, instead of costs, is becoming the most important labor force characteristic that determine locational FDI decisions.

The Model

After surveying literature dedicated to observing the labor market qualities that determine FDI, identifying the variables sufficiently representative of the skill level, labor cost, and productivity of the labor market is required to accurately depict these labor market qualities. The variables in the model are categorized to those representative of the qualities of the labor force as the literature has noted, and a host of other variables that determine FDI. As such, the initial specification of the model is:

$$FDI = f(LQ, CV)$$

Where FDI is the amount of inward FDI flows into a host country in 2008, LQ are the host of variables that reflect labor market qualities and CV are the host of control variables that determine FDI. As mentioned before, variables in LQ can be grouped into three categories: skills, cost, and productivity of labor.

It is important to note the definitions of FDI. Net FDI inflows the difference between FDI outflows and FDI inflows. The dependent variable in question in this research is FDI inflows also called inward FDI flows.

Labor Market Qualities

The multitude of labor force qualities identified by the literature must be selected with care to be feasible for research while at the same time representative of the qualities identified by the literature. The literature identifies wage rates, education levels, growth rates, size, health, skill levels, productivity, unionization, trainability, and bargaining ability as some of the important labor force qualities that attract FDI. The variables included in the model reflect these major determinants.

The education level of the labor force is measured by the Education Index component of the Human Development Index

and is represented by the variable EDU. This measure is representative of several determinants of FDI including productivity of the labor force, trainability, and the general skill level. Education levels can also roughly measure wage rates assuming that education is an investment and wages are the investment's expected returns. Larger the investment in education lead to higher the returns to those investments.

Education is expected to shift FDI from low cost labor intensive industries to high value research and development and technology industries. The value of inward FDI flows in Bangladesh garment factories for instance, is substantially lower than that invested in the pharmaceutical research firms in South Korea. Holding all other factors constant, this expected shift in FDI types because of increases in educational attainment causes the following relationship: as the education level of the labor force in a country rises, the total value of inward FDI flows is expected to increase at an increasing rate, reflecting the shift from low value labor intensive investments to high tech and R&D investments.

Labor force size, measured by the general employment level by thousands represented by the variable EMPGE, is also intended to measure population size with a correlation coefficient of .995. The general employment level can therefore proxy the market potential for market seeking, tariff jumping foreign direct investment.

The labor force's health level is proxied by the Life Expectancy Index component of the Human Development Index in the variable LFE. Although this measures the general health level, it is safe to assume that a healthy population has a healthy labor force. Along with a labor force's education level, the health measure adds to the approximation of labor force productivity.

Finally an approximation for the labor force's progressiveness can be measured by

the amount of females active in the labor force. The Population Reference Bureau's measure of the percentage of females active in the labor force provides this data. Represented by the variable ACTIVEF, this measure of progressiveness is included in the model.

Unlike education, the size, health and progressive nature of a labor force do not cause a similar shift in the type of FDI from low value manufacturing to high value high technology investments. Holding all other factors constant, an increase in the size of the labor force will increase the amount of foreign investment. However, the type of foreign investment does not change. As MNEs invest more into a country, their interests in diversifying their investments among countries and their investment budgets place a limit to the amount of investments they can commit to one country. Because of this limitation, as the size of the labor force increases, the total value of FDI is expected to increase but at a decreasing rate.

The expected relationship between labor force size and FDI also holds true for labor force health and progressiveness. As the labor force health improves and the labor force becomes more progressive, limited resources and investment diversification causes FDI to increase at a decreasing rate.

The four variables mentioned above approximate some of the identified determinants of FDI. They represent of most of the variables mentioned in the literature in a measurable manner. Although many more variables can be included they are not included in the model, for reasons of the lack of data, and statistical feasibility. Labor force education, size, health, and progressiveness comprise the labor force quality determinants of FDI. In the case of education and health, they reflect population qualities that have an impact on FDI.

With these variables, the specifications

for the labor qualities that determine inward FDI flows are:

$$L = f(EDU, EMPGE, LFE, ACTIVEF)$$

Control Variables

To successfully assess the labor force quality determinants of FDI, it is necessary to control for other variables that potentially affect FDI. Returning to Cho's arguments, he identifies economic conditions, host country policy and MNC strategies.

This paper explores all types of MNC FDI. Kinoshita points out that MNC strategies are largely contingent on their size: small MNCs look for low costs and sufficient infrastructure while large MNCs invest in large and more developed or more stable markets. Because analyzing MNC strategies requires us to differentiate MNCs by size, we do not include variables that explore MNC strategies based on their size. Instead, we analyze all MNC FDI in a set of countries. The literature suggests that FDI decisions are influenced by the size of the market the FDI is accessing (OECD 2000). Mentioned earlier, this is approximated by the general employment level and the size of the labor force.

Included in these economic conditions are the availability of infrastructure and technology and macroeconomic stability (Cho 2004). Supported by Nonnemberg and Mendonca, the model includes measures of macroeconomic stability in the form of inflation. In the model, this is the variable INFL. The variable INT represents the internet penetration in that country and is also included in the model as a measure of technological capacity and infrastructure investment.

Host country policies that influence FDI are also identified: the literature give importance to trade and investment poli-

Variable	Expected Values	Functional Form
<i>EDU</i>	$1 < x$	<i>Double Log</i>
<i>EMPGE</i>	$0 < x < 1$	<i>Double Log</i>
<i>LFE</i>	$0 < x < 1$	<i>Double Log</i>
<i>ACTIVEF</i>	$0 < x < 1$	<i>Double Log</i>
<i>INT</i>	$0 < x < 1$	<i>Double Log</i>
<i>TF</i>	$0 > x$	<i>Double Log</i>
<i>IF</i>	$0 < x < 1$	<i>Double Log</i>
<i>CPI07</i>	$0 < x < 1$	<i>Double Log</i>
<i>INFL</i>	$0 > x$	<i>Double Log</i>

Table 1: Variables

cies. The model includes trade freedom measured by the Trade Freedom and investment Freedom indices of the Index of Economic Freedom. Represented by the variables TF and IF, trade freedom measures the openness of an economy while investment freedom measure the ease or difficulty to invest in a country.

Finally, the risk perceptions of the host country are approximated by the Transparency International's Corruptions Perceptions Index (CPI). Countries with lower corruption are given higher scores in the index. Represented by the variable CPI07, the index is a measure of the perceived corruption in a country and proxies for the perceived risk in a country the quality of regulatory institutions, and political stability.

Of these control variables, trade freedom and inflation are expected to have a negative relationship with FDI. Because FDI often attempts to access markets, trade freedom reduces the need to use tariff-jumping inward FDI flows to access those markets. Importation replaces this FDI. For obvious reasons, increased inflation often reflects economic instability and higher risk, reducing FDI into high-inflation countries.

Although trade freedom and inflation are expected to have a negative relationship with inward FDI flows, theoretically, the value of inward FDI flows reach below zero. A given country can stop receiving inward FDI flows, bringing the value to zero, but cannot receive negative flows. This must not be confused with net FDI flows: the difference between FDI inflows and FDI outflows. Net FDI flows values can be negative. This limitation suggests that as trade freedom or inflation increases, FDI inflow decreases at a decreasing rate.

The other control variables, internet penetration, investment freedom, and the corruption index are expected to have a positive relationship with FDI. However, similar to the relationship between the size of the labor force and FDI inflows, limited resources and investment diversification cause FDI inflows to increase at a decreasing rate as internet penetration, investment freedom and the corruption index increase.

The aforementioned characteristics allow us to specify the control variables determining inward FDI flows:

$$CV = f(INT, TF, IF, CORR, INFL)$$

The model of the determinants of FDI inflows is complete. Table 1 summarizes the

variables and their expected relationships with FDI inflows.

An issue of causality arises when studying the determinants of inward FDI flows. Because investment decisions are made based on available information, investments in a given year t are often based on information from the year before, $t-1$. Addressing the issue of causality and ensuring that the dependent variable is determined by the independent variable, a lag of 1 year time period is applied to the model. The dependent variable relies on data from 2008 while the independent variables rely on data from 2007.

The specifications of the model used in this research paper are as follows:

$$\begin{aligned} \ln \text{FDI}_i = & \beta_0 + \beta_1 \ln \text{EDU}_i + \beta_2 \ln \text{EMPGE}_i \\ & + \beta_3 \ln \text{LFE}_i \\ & + \beta_4 \ln \text{ACTIVEF}_i \\ & + \beta_5 \ln \text{INT}_i + \beta_6 \ln \text{TF}_i \\ & + \beta_7 \ln \text{IF}_i + \beta_8 \ln \text{CPI}_i \\ & + \beta_9 \ln \text{INFL}_i + \epsilon_i \end{aligned}$$

Variables and Data Sources

Variable	Measure	Source
EDU	Education Index; from 0 to 1 in .001 point increments	UNDP HDR
EMPGE	In Thousands	ILO
ACTIVEF	Economically Active Females 15+ in %	PRB
LFE	Life Expectancy Index; from 0 to 1 in .001 point increments	UNDP HDR
INT	Per 100 Inhabitants	ICT
TF	From 0 to 100 in .1 point increments	IEF
IF	From 0 to 100 in 1 point increments	IEF
CPI07	From 0 to 10 in .1 point increments	CPI
INFL	GDP Deflator (annual %)	WBDI

Table 2: Measures and Data Sources

The data set used in this model is cross sectional data based on countries included in the lower middle income, upper middle income and higher income countries as categorized by the World Bank (WB). The sample includes 155 countries. Low income countries were not included for two reasons. First, they receive a very small portion of the world's inward FDI flows. Second, data on developing countries is limited reducing statistical feasibility of adding these countries in the model.

Data was collected from the United Nations Development Programme Human Development Report (UNDP HDR), the Population Reference Bureau (PRB), Index of Economic Freedom (IEF), Transparency International's Corruption Perceptions Index (CPI), the International Labor Office (ILO), the World Bank Development Indicators (WBDI), and the International Telecommunications Union Information and Communications Technology Statistics (ICT). Table 2 shows a list of the variables, their units of measure, and their sources.

The following descriptive statistics display the mean, maximum, and minimum values of each variable along with the standard deviations. Table 3 shows the summary statistics of the independent variable

	FDIF	EDU	EMPGE	LFE	ACTIVEF
Max	316112	0.993	769900	0.961	79
Min	-20030	0.45	21.483	0.332	7
Median	1716	0.888	3926.2	0.799	48
Mean	10722.7	0.861531	19015.31	0.781245	46.33043

Table 3: Summary Statistics of Labor Force Qualities

	INT	TF	IF	CPI07	INFL
Max	84.99999	90	90	9.4	22.75261
Min	0.129895	36.4	10	1.5	-7.89083
Median	26.21547	77.6	50	3.5	4.847964
Mean	31.40452	74.95726	52.5641	4.435821	6.273327

Table 4: Summary Statistics of Control Variables

and the labor force quality variables. Table 4 shows the summary statistics of the control variables.

The dependent variable FDIF measures inward FDI flows in US dollars in millions. Data is gathered from the UNCTAD FDIStat database. The United States receives the highest amount of FDI at \$316112 million. Interestingly, contrary to the theoretical claim that inward FDI flows cannot be negative, Ireland contributes the lowest value of inward FDI flows at -\$20030 million. Venezuela has the median inward FDI flows among the sample of countries at \$1716 million.

The independent variables EDU¹ and

LFE² are components of the Human Development Index published by the UNDP. Their values are based on a scale from 0 to 1 in increments of .001 points. Higher values present higher education levels and higher health levels. Interestingly, the highest education levels as reported by the UNDP, are in Cuba at 0.993. This value is attributed to universal education policies that have been in place in Cuba since the Cuban revolution in 1959. Cote d'Ivoire is ranked the lowest in educational level with an index score of 0.45. Japan is given the highest health and life expectancy with an index score of 0.961 while Lesotho has the lowest at 0.332.

The independent variable EMPGE measures the general employment level in thousands. This measure is highly correlated with the population and so serves as a proxy and a control variable for population and potential domestic market size. The

¹ Education Index of the Human Development Index is calculated with the following equation:

$$\text{EDU} = \left(\left(\frac{2}{3} \right) * \frac{\text{Adult Literacy Rate}}{100} \right) + \left(\left(\frac{1}{3} \right) * \frac{\text{Total Enrollment Rate}}{100} \right)$$

² Life Expectancy Index of the Human Development Index is calculated with the following equation:

$$\text{LFE} = \frac{\text{Life Expectancy at Birth} - 25}{85 - 25}$$

data comes from the ILO's LABORSTA database. As expected, China has the largest labor force at 769,900 thousand people and San Marino, an island state, has the smallest at 21.483 thousand. Hungary has the median labor force size at 3926.2 thousand people.

ACTIVEF proxies the progressiveness of the labor force by measuring the percentage of the female population above 15 years of age who are active in the economy. The data is provided by the Population Reference Bureau in the report Women of Our World 2005. Because this data set is not available for 2007, the most recent data available is used. According to this measure, Iceland has the most progressive labor force with 79% of its female population above 15 years of age active in the economy and Algeria has the least progressive labor force with only 7%. Trinidad and Tobago has the median progressive labor force with 48% of its women active in the economy.

INT measures internet penetration in the economy by measuring the number of internet users per 100 individuals in the population. It also serves as a proxy for infrastructure availability and technological achievement and adoption. The data is gathered from ICT. Norway has the highest internet penetration with 85 people per 100 in its population with access to and use the internet and Timor-Leste has the lowest internet penetration level with 0.130 people per 100. Colombia has the median internet penetration with 26.215 people per 100 with access to and use the internet.

The TF³ and IF⁴ variables are components of the Index of Economic Freedom. They measure trade freedom and investment freedom respectively. TF is measured from 0 to 100 in .1 point increments and IF is measured from 0 to 100 in 1 point increments. Singapore has the highest levels of trade freedom with an index score of 90 and Djibouti has the lowest at 36.4. Belgium, Estonia, Germany, Ireland, Luxembourg and the Netherlands have the highest investment freedom with scores of 90 points while Iran has the lowest investment freedom at 10 points. The country with median trade freedom was Azerbaijan with a score of 77.4 while several countries with median investment freedom have scores of 50.

The Corruption Perceptions Index⁵, the variable CPI07 in the model, measures the perceived general corruption level in the country. The index ranges from 0 to 10 at .1 point increments with a score of 0 being the highest level of corruption and 10 being the lowest. The measure was created by Transparency International. New Zealand, Finland and Denmark have the highest CPI score at 9.4 and therefore, the lowest perceived corruption levels. Iraq has the lowest CPI score at 1.5, and the highest perceived levels of corruption. Brazil, China and India are among several countries that share the median level of corruption with a CPI

³TF is calculated with the equation

$$TF = \left(\left(\frac{Tariff_{max} - Tariff_i}{Tariff_{max} - Tariff_{min}} \right) * 100 \right) - NTB_i$$

where $Tariff_{max}$ and $Tariff_{min}$ represent the upper and lower bounds for tariff rates (%), and $Tariff_i$ represents the weighted average tariff rate (%) in country i . NTB_i penalty is then subtracted from the base score for non-tariff barriers.

⁴ IF is calculated by taking a base score of 100 for a perfectly free investment environments and deducting points for investment restrictions imposed in the country. Different values are deducted for different restrictions. Further information is available in index of economic freedom website.

⁵ The CPI is measured from 14 different surveys over multiple years, measuring the total perceived corruption levels in a country.

	Variable	Coefficient	T statistic	Specifications
Labor Force Quality Determinants	$\ln EDU^*$	3.987075	2.50	$n=69$
	$\ln ACTIVEF^{***}$	-.4810134	-1.32	$Adj. R^2 = 0.7406$
	$\ln LFE^{**}$	-2.414732	-1.72	
	$\ln EMPGE^*$.7677965	10.36	
Control Variables	$\ln INT^*$.7049765	2.61	
	$\ln TF^{**}$	-3.149761	-2.04	
	$\ln IF^{***}$.6760712	1.58	
	$\ln CPI07$.6827258	1.20	
	$\ln INFL^*$	-.5339085	-2.44	

*, **, *** = Significant at $\alpha=.01$, $\alpha=.05$, $\alpha=.10$

Table 5: Regression Estimation

score of 3.5.

Finally INFL is the measure of the inflation rate in a country in 2007 measured in percentage. The data is gathered from the World Bank's World Development Indicators. Ukraine experienced the highest inflation in 2007 at 22.75261% and the democratic republic of Congo experienced deflation at -7.89083%. The median inflation rate of 4.847964% was the average value of Nigeria's and India's inflation rates⁶.

Regression Estimation

Table 5 outlines the final results of the regression model.

Labor Force Characteristics

Education is significant at $\alpha=.01$ in determining inward FDI flows and the model

⁶ In a set of values with n observations, when n is even, the median is calculated as the average of the two central values in the set

predicts the expected relationship between education and the total value of inward FDI flows. The $\ln EDU$ coefficient suggests that, holding all other factors constant, a 1% increase in the value of the Education Index Score in 2007 is associated with an approximate 3.9% increase in the total value inward FDI in 2008. This predicts that as the education level increases, the total value of inward FDI increases at an increasing rate, reflecting the expected shift in investments from low value manufacturing investments to high value research and technology investments. Because education also measures the productivity of the labor force, a similar relationship can be assumed between productivity and inward FDI flows.

Unexpectedly, the progressiveness of the labor force has negative effect on inward FDI flows in a country and is significant at $\alpha=.10$. The $\ln ACTIVEF$ coefficient suggests that, holding all other factors constant, a 1% increase in the percentage of economically active females in the population in 2007 correlates to a reduction of in-

Increasing at a Decreasing Rate	Decreasing at a Decreasing Rate	Increasing at an Increasing Rate
<i>EMPGE</i>	<i>TF</i>	<i>EDU</i>
<i>INT</i>	<i>INFL</i>	
<i>IF</i>	<i>ACTIVEF*</i>	
<i>CPI07*</i>	<i>LFE*</i>	

* = not significant at the 10% level; *: unexpected relationship

Table 6: Summary Relationships

ward FDI flows by .48%. This predicts that as more females are active in the economy, inward FDI flows decrease at a decreasing rate. A possible explanation for the unexpected relationship between the progressiveness of the labor force and inward FDI flows is explored in the next section.

A similar observation can be made for the relationship between life expectancy and FDI. Life expectancy has a negative relationship with inward FDI, significant at $\alpha=.05$ with the estimations predicting that, holding all other factors constant, a 1% increase in the value of the Life Expectancy index of a country in 2007 is associated with a 2.4% decrease in the total value of inward FDI in 2008. Similar to the findings on the progressiveness of the labor force, this predicts that longer life expectancy and better health in 2007 decreases inward FDI flows at a decreasing rate. A possible explanation for the unexpected relationship between the life expectancy and inward FDI flows is explored in the next section.

Finally, the size of the labor force has a highly significant positive relationship with inward FDI flows, significant at $\alpha=.01$. The expected relationship between labor force size and inward FDI flows is confirmed as well. The coefficient for the size of the labor force suggests that, holding all other factors constant, a 1% increase in the size of the labor force is associated with a .76% increase in inward FDI flows predicting that as the

size of the labor force in a country rises, inward FDI flows in that country increases at an increasing rate.

Control Variables

All the control variables were found to be significant in predicting inward FDI flows in a country with corruption being the only variable significant at an $\alpha>.10$. All expected relationships have also been confirmed by the model. Internet access, serving as a proxy for technological advancement and adoption, and infrastructure levels, are significant at $\alpha=.10$ and have a positive relationship with inward FDI flows predicting that as technological advancement and adoption increases, the inward FDI increases at a decreasing rate. This relationship can also be observed for investment freedom and the Corruptions Perceptions Index. Trade freedom is significant at $\alpha=.05$ and has a significantly negative relationship with inward FDI flows predicting that as trade freedom increases, FDI flows decrease at a decreasing rate reflecting the tariff jumping nature of inward FDI flows. This relationship can also be observed between inflation and inward FDI flows.

Table 6 summarizes the relationships between the independent variable and the dependent variable based on the estimation results.

Progressiveness and Life Expectancy

VIF, white and RESET tests found no multicollinearity, heteroskedasticity or omitted variables in the model begging an explanation for the unexpected relationships observed with the variables ACTIVEF and LFE. The UNCTAD World Investment Report (WIR) may provide an explanation for the unexpected results.

The WIR 2009 summarizes the FDI flows around the world for 2008 (see Appendix 1). The WIR 2009 states that, because of the financial and economic crisis in the first quarter of 2008, total FDI flows around the world fell by 14% from \$1,979 billion, to \$1,697 billion. This decline persisted into 2009 falling a further 44% by the first quarter of 2009 after a period of one year. More importantly, although global investment flows have decreased sharply, investment flows to transition economies and developing countries weathered the crisis far better than investments to developed countries.

Developed countries lost almost 30% of their FDI flows while transition economies' share in total FDI flows surged to 43% of the world FDI flows. Also, developing countries weathered the first half of 2008 better than developed countries because their banking and financial sectors were not as closely tied to those of developed countries where the financial crisis had originated. FDI flows to Africa increased by 27%, Latin America by 13% and Southeast Asia by 17% in 2008 (UNCTAD 2009).

This shift in the investment landscape provides an explanation for the unexpected relationships observed in the regression equation. Although simple correlation shows that larger economies still receive higher total values of inward FDI flows, when holding all other factors constant, inward FDI flows have shifted from developed countries with very progressive labor forces and high life expectancies to devel-

oping countries with less progressive labor forces and shorter life expectancies. This explains the negative relationships found between LFE and FDIF and ACTIVEF and FDIF.

Conclusions

This study focuses on the labor force qualities that determine or attract inward FDI flows. Coincidentally, the UNCTAD's observations on FDI movements in 2008 reveal that the year chosen for this cross sectional study is ideal. The shift of FDI flows from developed countries to developing countries provides the opportunity to study the important considerations in FDI decisions when shifting investments between countries. Specifically, this study finds that when MNEs decide to invest in developing countries, they look for the most productive, skilled and educated labor forces available. In attempting to gain access to a large market, MNEs also prefer larger labor forces. The general health and progressiveness of the labor force may be sacrificed by MNEs for the sake of gaining access to these educated and productive labor forces.

In addition to studying the labor force qualities that determine or attract inward FDI flows, this study also observes other determinants of FDI:

1. Corruption is not a major consideration when MNEs shift their investments from developed countries to developing countries. Studies finding that corruption may act as a lubricant for market transactions, lowering overall transaction costs and time delays in the national economy may contribute to this conclusion.
2. Inward FDI flows seek to tariff-jump in an attempt to access markets: lower trade barriers are disin-

centives for FDI decision makers. Countries looking to attract FDI must impose import quotas or tariffs to encourage tariff-jumping FDI.

3. Investment freedoms are relatively less significant considerations although are still more significant considerations than corruption (perhaps corruption having some spill-over effects in applicable investment restrictions).
4. Inflation and macroeconomic stability are the most important considerations in FDI decisions to access country's economy.

These conclusions offer significant insight in policy formation as it relates to attracting inward FDI flows. Countries must focus on attaining macroeconomic stability with low inflation rates, low unemployment, and high education levels if they want to attract inward FDI flows. Free trade and low import barriers may be detrimental to inward FDI flows because market access is a considerable component in inward FDI decision making and low trade barriers reduce the incentive and need to invest in a country.

Limitations, Improvements and Further Studies

The research process of this paper was confronted with difficult limitations. For developing countries and some developed countries, there is a lack of data for several variables thought to be important in determining FDI, crippling the ability to select the variables best suited to reflect certain characteristics and requiring the heavy use of proxies in the model. The limited number of countries with accessible information also limits the number of available observations in the regression model severely crippling the ability to perform hypothesis tests. Exacerbating this limitation, the

world hosts a limited number of countries – the United Nations for example, has 192 member states.

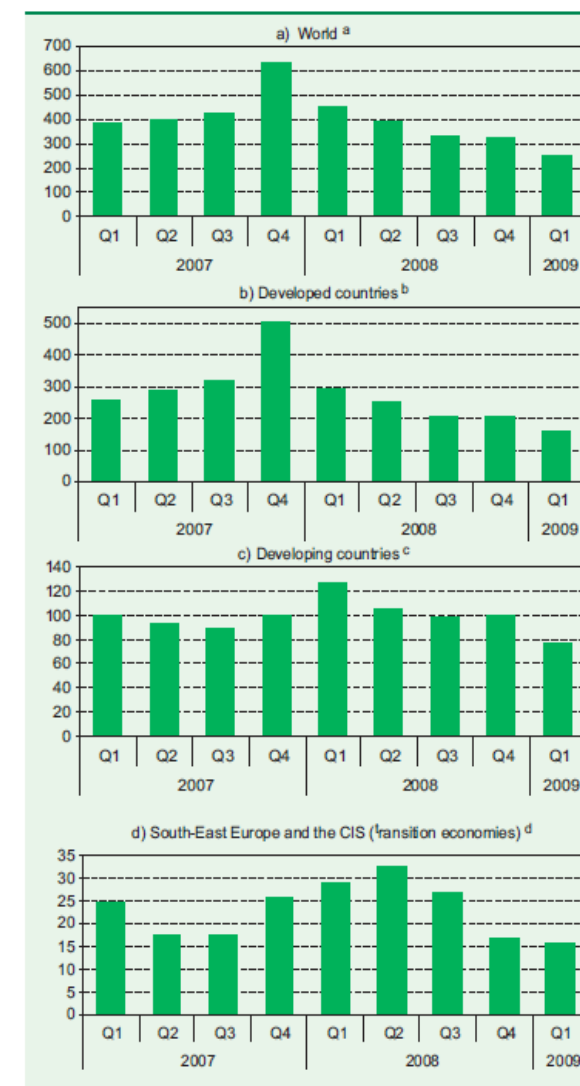
Added insights as the research progressed also reveal areas of improvement. Addressing the limitations of the data set, panel data analysis is the appropriate course to take when observing international activities and is frequently used in studies regarding FDI. Also, several variables maybe replaced with more appropriate specifications beginning with the independent variable: inward FDI flows as a percentage of GDP may be more appropriate than gross inward FDI flows (although the model presented no issues with heteroskedasticity). Finally, observing FDI on a less anomalous year than 2008 would provide more accurate insight to the considerations in FDI decisions during more regular periods in the business cycle.

The research performed for this paper has also opened up several further potential research questions. Three of the most pertinent include: 1) the determinants of the size of the decrease in foreign direct investment among developed countries in 2008, 2) the determinants of FDI outflows from a country, 3) comparisons of the determinants of FDI in the 2007-2008 economic crisis with other periods of global economic crises.



Appendix A:

World Investment Report (2009) FDI inflows, by quarter 2007-2009 (in billions)



Source: UNCTAD, *World Investment Report 2009: Transnational Corporations, Agricultural Production and Development*, figure I.12.

^a Total for 96 countries accounting for 91% of world inflows in 2007–2008.

^b Total for 35 countries accounting for almost all of developed country inflows in 2007–2008.

^c Total for 49 countries accounting for 74% of developing country inflows in 2007–2008.

^d Total for 12 countries accounting for 95% of South-East Europe and the CIS (transition economies) inflows in 2007–2008.

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Exploring the Absence of Inflation during Aggressive Quantitative Easing Programs

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Abstract

The Great Recession (2007-09) marked a new era of monetary policy in the United States. With interest rates depressed near zero, the Federal Reserve (Fed) decided to undertake rounds of quantitative easing (QE), a non-standard policy, in an attempt to stimulate the economy and bring the nation out of the recession. In its simplest form, QE involves the central bank purchasing government bonds, using mostly newly created currency, thereby increasing the money supply in an economy. In this study, a theoretical model will be employed to explain that any increase in the money supply, all else constant, will lead to long run price inflation. Following the theoretical discussion, this study will then utilize an econometric model to describe data from several major macroeconomic variables in the United States in an attempt to find parameters with explanatory power, using inflation as the dependent variable. This study concludes that increases in the money supply are associated with increases in the price level, consistent with economic theory. The model also shows that increases in the savings rate are negatively associated with the price level. Upon inspection of the data, this study suggests that the simultaneous increases in the money supply and savings rate, two competing parameters, have permitted the price level to remain relatively stable.

Introduction

Since the recent recession, commonly being referred to as the Great Recession, the United States has seen the Fed put the economy through two rounds of quantitative easing, and there is already discussion for a third round.¹ According to economic theory, increasing the money supply, *ceteris paribus*, will lead to a decrease in the value of money, an increase in the price level, and thus, inflation. With some relatively loose assumptions, this conclusion can be proved using simple theoretical models. Why then, with an increase in the monetary base of 147% in two years², are people discussing the risk of deflation, rather than discussing the risk of inflation? It is clear that there are some factors that are preventing the onset of inflation.

Recovery from the Great Recession is different than previous economic recoveries as the economic shock experienced was an aggregate demand shock, rather than an aggregate supply shock like the recessions seen in the 1970s and 80s. The quantitative easing programs that have been undertaken are attempts to stimulate demand, by making cash more available for consumers. Consumer data, collected from Federal Reserve Bank of St. Louis and United States Bureau of Labor Statistics, shows that the personal savings rate has trended upward since the beginning of the Federal Reserve's open market operations. This is quite interesting because previously, the personal savings rate in the United States had declined since the 1980s. This upward trend in savings is most likely due to a number of factors, such as risk aversion due to uncertainty in job future, lower per capita consumption levels, and general household deleveraging.³ Increases in the savings

¹QE2 was completed by the end of Q2 2011.

²Source: Federal Reserve Bank of St. Louis, 2007-09

³Source: "Proceed with Caution," *Economist*, 2010.

rate lead to lower levels of current period consumption and therefore, potentially reduce the effectiveness of quantitative easing programs. Through the creation of an adequate econometric model, a statistical relationship between inflation, as measured by the consumer price index (CPI), and the personal savings rate can be estimated. With an established approximation of the connection between these two variables, an argument can be made regarding the effect of an increasing savings rate on inflation during a period in which money supply is more than doubled.

The empirical model created in this study yields results that suggest that money supply and the personal savings rate affect the price level in opposite directions. The magnitudes of the coefficients on these variables are similar, with the personal savings rate having a slightly larger effect. According to empirical data, the movement of these variables in recent months has been quite similar. This study concludes that it is possible that inflation has been deferred, or perhaps even prevented, by the escalation of the personal savings rate during this period of monetary expansion.

Literature Review

Near the end of 2008, the Fed simultaneously lowered the interest rate to near zero and began injecting a steady stream of cash into the economy, totaling 1.7 trillion dollars to date (April, 2011). Quantitative easing was used as a policy instrument once the interest rate was depressed near zero, since rate adjustments at this level were no longer feasible. This study begins with a macroeconomic analysis of a simplified theoretical economy. Fama (1982) discusses the money-demand theory and concludes that, theoretically, increases in money supply are tied to increases in the price level and therefore inflation. He also deduces from this theoretical

framework that negative changes in the interest rate lead to increases in the price level. Consequently, adjustment of the Federal Funds rate down should induce inflation. This study employs Fama's conclusion that the monetary base should be used as a measurement for money supply, as changes in this variable are significant in regression models more often than variation in other measurements such as M1, M2, etc.

Schenkelberg and Watzka (2011) performed a lengthy study of Japan and determined that quantitative easing undertaken in the 1990s led to short run increases in industrial activity, while leaving inflation levels untouched. The lack of inflation, however, hinges on the assumption that the monetary policy undertaken is a relatively "small" shock. The magnitude of Japan's quantitative easing program was roughly \$300 billion USD or 6% of Japan's gross domestic product (GDP) over a four year period. The United States' program, on the other hand, has reached \$1.7 trillion USD or 10% of United States' GDP over the last two years, with talks to increase this number in 2011. While there is no clear definition of a "small" shock, it is obvious that the United States program has the potential to have different consequences than the Japanese program, as it is twice the relative magnitude in half the time period. Since the two programs differ so significantly in magnitude, the conclusions made by Schenkelberg and Watzka regarding Japan may not necessarily apply to the United States. The intent of this study is to fill this gap in research by suggesting that while changes in money supply should, theoretically, yield inflation, other variables are preventing the rise in the price level in the United States at this point in time.

Schenkelberg and Watzka (2011) also chose CPI as the measurement for inflation in their research. The advantages of this variable as a measurement of inflation are clear: aside from being a direct measure of

the price level, CPI is also reported monthly. The other parameter that can be used to measure inflation, the GDP deflator, is reported quarterly and thus, yields only

25% of the data that the CPI captures in the same time period. A requirement for an adequate econometric model is a large data set and thus, this study will utilize the CPI as the measurement of inflation in the United States economy.

Mervyn King (2002) makes it clear in his piece that money should never be considered the only variable affecting inflation. King gives data that clearly illustrates the fact that the rate of change in money supply is correlated with changes in inflation. The magnitude of these changes, however, is dependent upon future inflation expectations. The monetary authority, King argues, can reduce inflation by installing policy that reduces public fear of future inflation. In the recent hyperinflation cases in Argentina and Israel, inflation skyrocketed until the monetary authority eased inflationary expectations by enacting anti-inflationary policy. After this action by the government, the data presented shows a clear leveling off of rises in inflation. Quantitative measurement of inflation expectations is near impossible; there is no direct or proxy variable that truly captures variation in this parameter. While policies like quantitative easing and fiscal stimulus may affect inflation expectations, the magnitude of their effects are incalculable and, while useful in theory, there are no such parameters that could be included in an econometric model to potentially explain inflation in an economy.

King discusses the difference between the short and long run effects of money on the price level. Recent data shows that Keynesian IS-LM framework proves to be correct; increases in the supply of money have minimal inflationary effects in the short run. In the long run, however, inflationary pressures are felt due to increases in the supply of money. King also claims that

changes in output are due only to real factors and thus, increases in money supply do not lead to significant increases in output in the long run. The increase in money supply, as argued, manifests itself in increased price levels, rather than increased output levels. Recovery efforts in the United States have been focused on immediate, temporary increases in demand, rather than increases in the long run. Thus, quantitative easing is the proper policy for achieving this goal. While King suggests that increases in money supply are associated with increases in the price level, he never discusses factors that inhibit inflation. The objective of this study is to uncover parameters that appear to prevent the onset of inflation.

Modeling Inflation

In order to model changes in the price level due to increases in the money supply in the United States economy, we begin with the two period overlapping generation model developed by Samuelson (1958). We assume the only two agents in the economy are the government and a homogenous group of consumers. While homogenizing consumers may appear to be an oversimplification, these agents are used only to observe the change in the price level in the economy. This study makes no comments on the actions of the consumer based on these changes in prices, as it is nearly impossible to assume that all consumers in an economy will react in the same manner to price changes. This discussion will focus on the aggregate economy, as the decisions by all agents collectively drive the price level. Motivated by the work of Champ and Freeman (2001), we define the growth in the money supply as

$$M_t = zM_{t-1},$$

where z is the gross rate of monetary expansion and each time period is denoted by t . Since the aim of this study is to ex-

plore expansions in the money supply, we will assume $z > 1$. From Sargent and Wallace (1983), we establish that consumers are subject to a budget constraint each period defined as

$$c_t + v_t m_t \leq y,$$

where c_t is consumption, v_t is the value of money in terms of the consumption good, m_t is the quantity of money held by an agent and y is a consumer's endowment in terms of the consumption good. All variables are shown here in terms of time period, t .

We then aggregate the budget constraints of all consumers in the model economy and find the equality of supply and demand in the money market to be

$$v_t M_t = N_t(y - c_t),$$

where M_t is the aggregate money supply and N_t is the population, both listed in terms of time period, t . Next, we must isolate v_t which leaves us with

$$v_t = \frac{N_t(y - c_t)}{M_t}.$$

To find changes in the price level, we must first observe how the rate of return of money changes by period. To explore this relationship, we define rate of return of money to be

$$\frac{v_{t+1}}{v_t} = \frac{\frac{N_{t+1}(y - c_t)}{M_{t+1}}}{\frac{N_t(y - c_t)}{M_t}}.$$

Since quantitative easing policies involve large injections of cash in relatively short periods of time, we assume that population remains constant between the two periods. Therefore, the above formula simplifies to

$$\frac{\frac{1}{M_{t+1}}}{\frac{1}{M_t}} = \frac{M_t}{M_{t+1}} = \frac{M_t}{zM_t} = \frac{1}{z}.$$

The price level is inversely related to the value of money, therefore

$$p_t = \frac{1}{v_t},$$

where p_t is the price level in time period, t . The ratio of price levels between periods can be used to inspect inflation. This ratio is defined as

$$\frac{p_{t+1}}{p_t} = \frac{\frac{1}{v_{t+1}}}{\frac{1}{v_t}} = \frac{v_t}{v_{t+1}} = z.$$

Through some simple algebra, the price level in the second period, $t + 1$, can be defined in terms of p_t :

$$p_{t+1} = zp_t \quad (\text{Equation 1})$$

While the formula above appears quite simple, it has very powerful implications. Presuming the assumptions of the model hold true, a value of $z > 1$ will lead to $p_{t+1} > p_t$ and therefore, inflation in the economy. With this proof in mind, we will now employ econometrics to explore potential parameters that are preventing this seemingly inevitable effect from manifesting itself in the United States economy.

Empirical Model Specification

In order to explore the conclusion of the theoretical model (Equation 1), an empirical model must be built that allows the relationship between the price level and the supply of money to be isolated. In order to accomplish this, a model must be constructed that controls for other variables that influence the price level in the econo-

my, so that the variation in the price level captured by the coefficient placed on the supply of money parameter is an unbiased estimator of the true relationship, rather than a false result due to omitted variable bias. By creating a properly specified model that controls for other factors that influence changes in the price level, we can also seek out potential reasons why inflation has been relatively tame in a time of such aggressive monetary expansion.

In the following section, the framework for the econometric model of the price level will be outlined. The data used for empirical testing was gathered from the Federal Reserve Bank of St. Louis (STLF) and the United States Bureau of Labor Statistics (BLS) from January of 1990 to December of 2010 (N=251 obs). All variables used were reported monthly, with the exception of GDP and velocity of the M1 money stock. In the case of GDP, monthly data was estimated by using cubic spline interpolation. It should also be noted that all data used was seasonally adjusted to help correct for temporary fluctuations in many variables.

As previously stated, the measure chosen for inflation will be the consumer price index (Schenkelberg and Watzka, 2011). For the empirical model in this study, we will be using the log of the consumer price index for obvious reasons. Primarily, the log form makes the interpretation of the results more intuitive; at all times, we will be speaking about changes in consumer price index in percentage terms. This makes the magnitude of estimator values easier to compare. In order to adjust for magnitude, we also elected to place the monetary base, reported in billions of dollars, in logarithm form.

A number of the variables in the model were found to be non-stationary through testing with the Dickey-Fuller test for unit root. The variables that failed this test were monetary base, Federal Funds rate and un-

employment. In order to correct for this problem, the first difference of these variables must be used; this was easily generated using STATA data analysis software. The first difference form of these variables can be used because this construct of the variable is typically weakly dependent and stationary (Wooldridge, 2009).

While the log of the consumer price index was found to be non-stationary, it was determined that the variable was a trend-stationary process. To correct for this, the variable must be detrended by regressing the variable on the time variable and saving the residuals. The residuals can be defined as the log of the consumer price index, detrended. These residuals pass the Dickey-Fuller test and thus, can now be considered stationary. In order to confirm no unit root exists in the final regression, a Dickey-Fuller test is performed on the residuals. When executed, this test confirmed that no such unit root existed and therefore, the model could be declared properly specified.

Based on extensive literature review, the empirical model constructed in this study is one of the first of its kind. No previous literature could be found that created a model relating macroeconomic variables to inflation in an economy in this manner. Thus, rather than motivated from previous literature, this model was created through extensive testing. The resultant model does, however, utilize specific measures mentioned in literature, such as the consumer price index as a measure of inflation (Schenkelberg and Watzka, 2011), and the monetary base as the measure of the supply of money (Fama, 2006). With this in mind, the following model was generated:

$$\log CPI_t = \beta_0 + \beta_1 \log MB_t + \beta_2 SR_t + \beta_3 FFR_t + \beta_4 MV_t + \beta_5 GDP_t + \beta_6 UNM_t + \beta_7 t + u_t.$$

Where:

Monetary Base (MB)

- CPI_t = Consumer Price Index, seasonally adjusted (SA), detrended, at time t (STLF)
- MB_t = Monetary Base, SA, at time t (STLF)
- SR_t = Personal Savings Rate, SA, at time t (STLF)
- FFR_t = Effective Federal Funds Rate at time t (STLF)
- MV_t = Velocity of M1 Money Stock, SA, at time t (STLF)
- GDP_t = Real Gross Domestic Product, SA, at time t (STLF)
- UNM_t = Unemployment, SA, at time t (BLS)
- t = Time, in integers

Interpretation of Coefficients

The model constructed captures a reasonable amount of the variation in the dependent variable, yielding a correlation coefficient of 0.1737. The coefficients estimated in the OLS regression are mostly significant and are of magnitude and sign (+ or -) that match economic intuition. Four of the variables in the model are significant at the 5% level, while the monetary base is significant at the 10% level and unemployment is insignificant. Through testing, the model was found to have no disrupting bias and thus, being properly specified, we can interpret the coefficients and discuss their explanatory power with confidence. The results of the regression are summarized in Table 1.

Since the regressor and regressand are both in logarithmic form, the coefficient on monetary base must be interpreted in percentage terms. Also, since the first difference of the process was used, the parameter's effect on the price level is described in terms of deviation from the trend. Thus, holding all else constant, a 1% increase in the monetary base is, on average, associated with a 0.0471% increase in the price level above its trend. The fact that the coefficient is positive confirms the conclusion yielded by the theoretical model; all else equal, an increase in money supply is associated with an increase in the price level. A coefficient value which is less than 1% also matches intuition; we would not expect increases in the price level to exceed the magnitude of the increases in the money supply. If the rate of increase in the price level were to exceed the rate of increase in the money supply, there would not be enough cash to facilitate transactions. Theoretically, this would be a practical impossibility.

Personal Savings Rate (SR)

While the personal savings rate is in level form, the data is measured in percentage terms. Accordingly, the coefficient must be interpreted in percentage terms, accounting for the fact that the relationship is log-level. Holding all else constant, a 1 percentage point increase in the personal savings rate is, on average, associated with a 0.0570% decrease in the price level. This result mirrors the conclusions of Keynes's AD-AS model; an increase in savings can be thought of as a decrease in aggregate demand and will lead to a reduction in the equilibrium price level in the long run. Following the discussion of each variable, the specific relationship between the coefficients yielded for personal savings rate and monetary base will be discussed in depth. It should be noted here, however, that, as hypothesized, the two variables work in opposite directions.

Effective Federal Funds Rate (FFR)

Similar to the personal savings rate, effective Federal Funds rate is in level form, while the data is reported in percentage terms. Furthermore, because it was found that this process followed a random walk, the first difference was used in the regression. Holding all else constant, a 1 percentage point increase in the effective Federal Funds rate is, on average, associated with a 0.337% decrease in the price level below its trend. The negative correlation of this coefficient estimated by the model matches the conclusion of Fama (1982). An increase in this rate makes debt more expensive and therefore causes investment expenditure and other high cost, debt intensive consumption to decrease. As a result, the price level will decrease with increases in the rate. The reverse of this reasoning explains why decreases in the Federal Funds rate are used by the government to encourage consumption in times of recession.

Velocity of M1 Money Stock (MV)

The data for velocity of M1 money stock was reported as a percent change in order to make interpretation of the data more intuitive. A one point change in velocity does not mean anything obvious because the data is reported as a ratio of nominal GDP to M1 money stock. What exactly is a one point change in a ratio? A better interpretation of the variable is one that measures a percent change in the ratio, as this is much easier to conceptualize. The percent change of a ratio is the percent change of the numerator minus the percent change of the denominator. With this in mind, holding all else constant, a 1% increase in the velocity of M1 money stock is, on average, associated with a 0.0817% increase in the price level. Ellis (2009) discusses the quantity theory of money in his piece and defines it as:

$$MV = PY,$$

where M is supply of money, V is velocity of money, P is the price level and Y is GDP. Since the empirical model created controls for money supply and GDP, an increase in the velocity of money must yield an increase in the price level and this is exactly what we see.

Real Gross Domestic Product (GDP)

Similar to other variables in the model, the data for GDP is reported as a percent, although in this case, it is a percent change. Regardless, the coefficient must be explained in a similar manner to the other variables measured in percent terms, but placed in level form. Holding all else constant, a 1 percentage point increase in GDP is, on average, associated with a

0.194% decrease in the price level. Returning to Keynes's AD-AS framework, an increase in GDP, which can be viewed as essentially an increase in aggregate supply, controlling for all other variables, will lead to a decrease in the price level in the long run.

Unemployment (UNM)

Unemployment data is recorded as a percent of those seeking work but not able to find a position. Since this process was found to follow a random walk, the first difference of the variable was used. When tested, unemployment was found to be insignificant in the model used in this study, therefore, we cannot comment on the coefficient produced by the model for this variable. If the model had produced a significant result for unemployment, we would have expected it to be, at the very least, negative. An increase in unemployment in a population can be viewed as a negative wealth effect for the people. With a decrease in wealth, consumption will also decrease. Again, resorting to the Keynesian model, declines in aggregate demand are associated with long run decreases in the price level.

Relationship Between MB_t and SR_t

Through the last few sections, the econometric model was described and it was made clear that all significant variables match economic intuition and Keynesian theory. Since the model was also shown to be properly specified, we can trust the empirical results when we make deeper conclusions regarding the relationship between the savings rate and the money supply. From the model, we found that the magnitude of the effect of a 1 percent change in both, the personal savings rate and the monetary base, is roughly the same, with the personal savings rate having a slightly larger effect. While the magnitudes of the coefficients are similar, the directions are opposite to one another. Thus, an increase in both variables of the same magnitude in the same time period will lead to nearly equal, exactly opposite effects on the price level, according to the empirical model. This conclusion suggests that a simultaneous increase in the personal savings rate, on the same order of the expansions in the monetary base, could potentially be the reason inflation is being suppressed.

Before inspecting recent data on the two variables, it should be noted why savings is targeted as the reason inflation has not exploded. While the model contains other variables that are associated negatively with the price level, these variables have remained relatively flat since the crisis (Figure 1). When looking at the changes in the data for savings (Figure 2), we see that since January of 2007, the savings rate has increased 145%⁴. In this same time period, the monetary base has increased 138%, a similarly sized change. With these facts in mind, it is quite plausible that the significant increase in the savings rate is responsible for curbing inflation. From this conclusion, it is clear that monetary expansion in a time in which the savings rate increases, assuming other variables affecting inflation

remain relatively flat, leads to sustainable, rather than aggressive, inflationary levels.

Policy Implications

Since we have concluded that printing money, all else equal, is associated with inflation, how can a government institute such a policy in an effective manner and achieve successful results as were seen in Japan, without the unintended consequence of inflation? As pointed out by Schenkelberg and Watzka (2011), the monetary expansion undertaken should be of small magnitude, relative to GDP. In recessionary times, it is reasonable to assume that the savings rate will increase throughout the country, as many agents experience negative income shocks. Since the savings rate will rise, a modest increase in the money supply should not move the needle. When the monetary expansion becomes a significant portion of GDP, QE becomes a concern. As shown by the model, if the changes seen in these two variables are on the same order, it is possible that inflation will be suppressed.

The beauty of quantitative easing is the speed at which the Fed can adjust the monetary base. As agents recover from the economic shock, it is probable that savings rates will decline and consumption levels will rise. With access to extensive consumer data, the Fed will be able to observe this shift from saving to consumption and adjust the monetary base accordingly. In the event the Fed ignores this change in preferences and fails to remove cash from the economy, it is possible that inflation could quickly rise. As postulated by many researchers and journalists⁵, the

Fed must be cognizant of the consumer population and react quickly and accordingly to ensure the price level remains stable.

⁵Source: "Charles Plosser and the 50% Contraction in the Fed's Balance Sheet," by J. P. Hussman, 2011.

⁴From January, 2007 to December, 2010

During times of QE, the Fed can also temper inflation, as outline by King (2002), by keeping expectations of the price level increases low. Based on the magnitude of the United States QE programs, the only clear way to temper such expectations would be to pull back some of the cash, or reverse QE! As of today, April of 2011, the monetary base of the United States has reached nearly 2.5 trillion dollars, more than 200% larger than prior to the recent recession. A claim by the Fed that no inflation will prevail without any corresponding action will not keep inflationary expectations low. Trust for the Fed is already low, as there is a large sector of the population that feels the government is simply monetizing its debt through QE, even though the government repeatedly denies this claim. Clearly, with limited trust from the American people, words without action will not elicit the desired consequence: stable price levels.

Future Research Considerations

While this study, supported by empirical evidence, provides an intuitive explanation for the absence of inflation, deeper levels of research should be pursued to strengthen this thesis. While the United States economy is unique, additional data from other countries in which QE has been undertaken should be collected and placed in the empirical model developed in this study. If the empirical model developed in this study holds for these places, (Japan, U.K, and the Eurozone), it will add significant strength to the conclusions reached through interpretation of the coefficients.

Beyond simply expanding the data, the model itself could also be modified. While the coefficients were shown to match Keynesian theory, many of the effects, such as the price level and output, are said to experience changes in the long run, rather than in the short run, according to Keynes. As suggested by Wooldridge (2009), lagged endogenous variable models can be used to describe long run stationary equilibrium.

By simply inspecting Figure 2, it is clear that the personal savings rate lags GDP. While GDP is not explicitly shown, the shaded region represents the recent recession (1.5 years of declining GDP). Savings does not increase significantly until five months following the shock to GDP; clearly this variable changes at a different rate than GDP. Similar to the savings rate, it is quite possible that the price level changes in the long run, rather than short run. More data may be required, however, it would be interesting to run models that lag the price level and see how this changes the conclusions of the model. This will also allow us to determine whether Keynes's conclusion, that the price level adjusts in the long run, is correct and to estimate what exactly is the time horizon of the long run.

In addition to empirical expansion, the theoretical model used in this study can also be extended. Similar to the price level, monetary theory can also be used to derive a relationship between consumer savings, consumption and supply of money. The proof of this relationship is quite intuitive and would strengthen the empirical conclusions by offering an additional theoretical link to explain why increasing savings decreases the price level.

Conclusion

With near zero interest rates, the Fed decided to utilize QE in an attempt to rouse the United States economy from its recessionary trough. While such a policy has been used in other countries with success in the past, the magnitude of QE in the United States is significantly larger. With such a considerable expansion in the monetary base, the lack of inflation is surprising. It can be proven with some relatively loose assumptions in a theoretical framework that expansions in the money supply, holding all else constant, lead to escalations of the price level. With this relationship established, it becomes obvious that there must be some factors that are preventing the onset of in-

Works Cited

flation in the United States.

Through a well specified empirical model, relationships can be isolated between the price level and other significant macroeconomic variables. The model created in this study determined that the price level is positively associated with the size of the monetary base and negatively associated with the personal savings rate. Both results match intuition and both also have coefficients on nearly the order of magnitude. Upon inspection of recent macroeconomic data (Figure 1), it is clear that while other variables remained relatively stable, personal savings rate and the monetary base have experienced large increases of roughly the same size. Based on the conclusions of the empirical model, it is quite plausible that the price level has remained relatively stable because of the simultaneous increase in the personal savings rate and the money supply.



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Appendix A: Empirical Model Results and Robustness Testing

Table 1: Regression Results

Dependent Variable: $\log CPI_t$, Detrended	
	(1)
Intercept	0.00461 (0.00143)**
$\log MB_t$ (in bn USD)	0.0471 (0.0273)*^
SR_t (in %)	-0.000570 (0.000205)**
FFR_t (in %)	-0.00337 (0.00148)**^
MV_t (in % change)	0.000817 (0.000225)**
GDP_t (in % change)	-0.00194 (0.000535)**
UNM_t (in %)	0.000762 (0.00186)^
t (in integers)	-0.0000101 (4.65e-06)**
R-squared	0.1737
Adjusted R-squared	0.1499

Number of observations is 251

Standard errors are in parentheses

^first difference of variable is used

**significant at 5%, *significant at 10%

Table 2: Robustness Check Results (Data from January, 1990 to December, 2007)

Dependent Variable: $\log CPI_t$, Detrended	
	(1)
Intercept	1.64e-08 (0.00222)
$\log MB_t$ (in bn USD)	-0.0702 (0.0981)^
SR_t (in %)	-0.0000295 (0.000302)
FFR_t (in %)	-0.00222 (0.00143)^
MV_t (in % change)	0.000653 (0.000219)**
GDP_t (in % change)	7.59e-06 (8.43e-06)
UNM_t (in %)	-0.000643 (0.00187)^
t (in integers)	6.19e-07 (8.43e-06)
R-squared	0.0702
Adjusted R-squared	0.0388

Number of observations is 216

Standard errors are in parentheses

^first difference of variable is used

**significant at 5%,

Comments: The above table is the results of a regression using data from 1990 to 2007. This regression was used to partial out the effects of the recent recession and the major monetary expansion that occurred thereafter. As it is clear by the results, the majority of the power of the model comes from explaining the robust fluctuations in the variables seen after 2007. It is no surprise that the model generated without the 2008+ data produces nearly no results with explanatory power. Shown in Figure 1 and Figure 2, the data is highly robust following the crisis.

Appendix B: Selected Graphs of Macroeconomic Variables

Figure 1: All variables, except Savings, plotted as Percent Changes since 2007

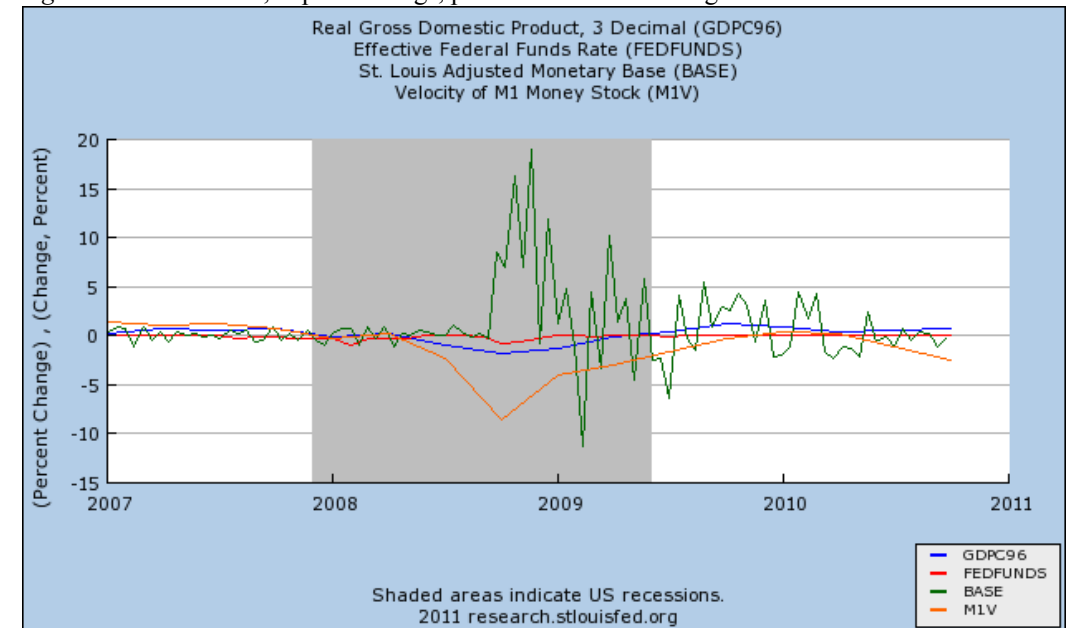
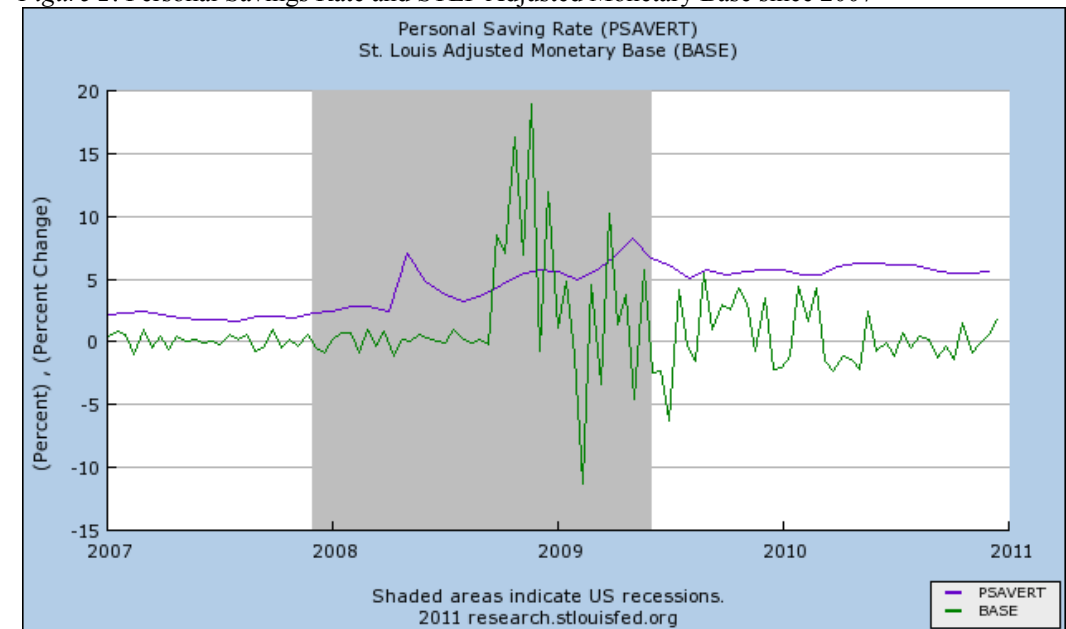


Figure 2: Personal Savings Rate and STLJ Adjusted Monetary Base since 2007



The Effect of Privatization Method on Inequality in Eastern European Transition Economies

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Transition economies in Eastern Europe experienced a drastic change in both income and consumption inequality following privatization of the public sector using voucher, sale, and management-employee buyout methods of privatization. This paper draws on the insights of Bennett, Estrin, and Urga's (2007) study regarding the effect of privatization method on the growth rate of transition economies, and instead analyzes the effect of privatization method on income and consumption inequality. To do this, factors that contribute to the phenomenon of inequality are studied. The three privatization methods are demonstrated to have insignificant effects on changes in income inequality, but significant effects on changes in consumption inequality. The sale and management-employee buyout methods are shown to be associated with an increase in consumption inequality, while the voucher method is shown to be associated with a decrease in consumption inequality, for the decade following privatization.

Introduction

The transition from a communist to a market economy in Eastern Europe, following the fall of the Soviet Union in 1991, allowed a small segment of society to rise above the rest due to high commodity prices and foreign investment in the 1990s. Moscow, once a markedly unglamorous area, is

now considered one of the most promising luxury markets in the world. However, not all citizens of former-communist countries benefited equally, as demonstrated by high levels of inequality. The trade-off between economic growth and income inequality is an important issue to address when deciding the method by which an economy should transition to a market economy. A stark reduction in equality across transition economies has been viewed as a natural part of transition, along with economic growth. However, consumption and income inequality did not increase uniformly. This paper looks at the effects of different privatization methods on both income and consumption inequality.

In 2000, the International Monetary Fund officially listed 29 countries as transition economies, and in 2002, the World Bank additionally defined Bosnia & Herzegovina, Yugoslavia, and Mongolia among them. A complete listing of transition countries located in Eastern and Central Europe, as defined by the European Bank for Reconstruction and Development (EBRD), is provided in Table 1. The EBRD also provides transition method classifications and privatization years for these countries, as shown in the Table 1.

In these transition economies, high levels of income inequality have been blamed on lower levels of economic growth, and vice versa. A large middle class could be beneficial for a successful transition because it is more in that group's interest to continue the transformation than it is for others, like the poor or the elderly, who might prefer the previous economy. On the other hand, development may require some amount of income inequality. When wealth is concentrated in the hands of a few, those hands can build industries that will create jobs and growth. Additionally, some policies enacted to decrease income and consumption inequality also hinder economic growth, such as redistributing wealth through excessive taxes. As John F. Kennedy famously

	Country	EU Member	NIS	Method	Year of Priv.
1	Albania	No	No	MEBO	1995
2	Armenia	No	Yes	Voucher	1994
3	Azerbaijan	No	Yes	Voucher	1997
4	Belarus	No	Yes	MEBO	1994
5	Bosnia & Herzegovina	No	No	Voucher	1999
6	Bulgaria	Yes	No	Sale	1993
7	Croatia	No	No	MEBO	1992
8	Czech Republic	Yes	No	Voucher	1992
9	Estonia	Yes	Yes	Sale	1993
10	Georgia	No	Yes	Voucher	1995
11	Hungary	Yes	No	Sale	1990
12	Kazakhstan	No	Yes	Sale	1994
13	Kyrgyz Republic	No	Yes	Voucher	1996
14	Latvia	Yes	Yes	Sale	1992
15	Lithuania	Yes	Yes	Voucher	1991
16	Macedonia, FYR	No	No	MEBO	1993
17	Moldova	No	Yes	Voucher	1995
18	Poland	Yes	No	Sale	1990
19	Romania	Yes	No	MEBO	1992
20	Russian Federation	No	Yes	Voucher	1993
21	Slovak Republic	Yes	No	Sale	1995
22	Slovenia	Yes	No	MEBO	1998
23	Tajikistan	No	Yes	Sale	1997
24	Turkmenistan	No	Yes	MEBO	1994
25	Ukraine	No	Yes	Voucher	1995
26	Uzbekistan	No	Yes	MEBO	1995

Table 1. Transition Economies

Source: EBRD 1999 Transition Report

Note: NIS refers to New Independent States, which are previous members of the Soviet Union; MEBO refers to management-employee buyout

said in 1962 when proposing lower taxes on the rich, "A rising tide raises all boats."

According to Keane and Prasad (2001), "It is well known that in most of the countries of Eastern Europe and the former So-

viet Union making the shift from central planning to market economies, income inequality increased substantially during the first decade of transition." But before analyzing both income and consumption inequality, it is important to understand

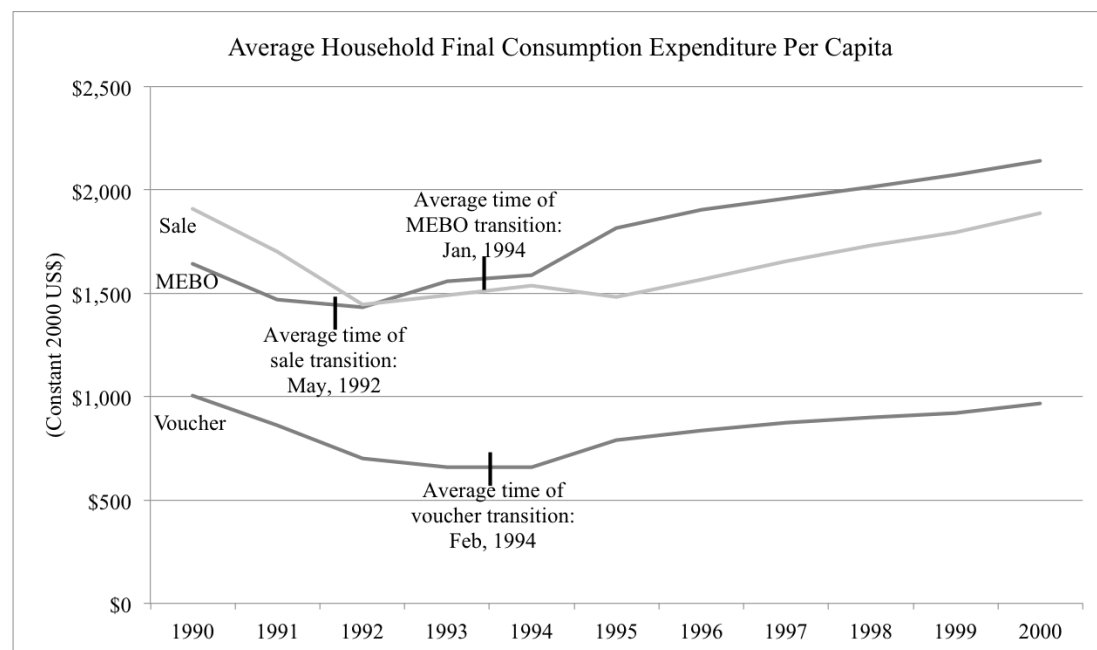


Figure 1. Trends of Consumption Expenditure by Privatization Method

Source: World Bank Development Indicators 2011

Note: Bosnia & Herzegovina, Georgia, Turkmenistan, and Uzbekistan excluded due to data unavailability

that the overall standard of living in these countries that have improved. In general, real average income has increased steadily over the last decade (until the global financial crisis of 2008). Figure 1 depicts average annual consumption expenditure per capita during the 1990s, organized by privatization method. While countries that used sale and management-employee buyout privatization had significantly higher living standards than countries that used the voucher method, all countries experienced a marked increase in consumption following 1994.

Another example of increased living standards is the rise of minimum wages. Minimum wages in Eastern European countries have been increasing dramatically with the improvements in the economy. For example, in Estonia, Latvia, and Poland, minimum wages have increased 448%, 185%, and 111%, respectively, from 1995 to 2004 (Funk and Lesch, 2005).

As shown in Table 1, transition economies in Eastern Europe used three methods of privatization—voucher (also known as mass), sale, and management-employee buyout (MEBO). The categorization of countries under these three categories is crucial to determining each method's effect on inequality. This paper will use the EBRD's categorizations of countries under these three methods, as published in its 1999 Transition Report. The categorizations are defined here:

- Voucher, or mass, privatization refers to privatization in which citizens are given or can inexpensively purchase vouchers that represent shares in a state-owned company.
- Sale privatization refers to privatization in which these shares are sold to the public and often to foreigners.

- Management-employee buyout (MEBO) refers to privatization in which only members of the firm, managerial and otherwise, can buy the shares, usually causing an initial concentration of shares in the hands of fewer people than other privatization methods.

I will evaluate the ways in which the different methods of privatization applied to transition economies affected income and consumption inequality throughout the decade following each country's transition. I will first review past literature on inequality in transition economies, focusing on the determining factors that the literature uses to best model inequality. Then, I will present data and descriptive statistics, describe my multiple regression equation, and finally analyze the results in order to support the argument that the methods of privatization did not significantly affect income inequality, but did significantly affect consumption inequality.

Literature Review

This section gives an overview of the methods used in transition economy literature to study inequality. First, I survey the countries and years upon which the literature focuses. Second, I present the ways in which the literature measures inequality, and what sources of data are used. Third, I examine how the literature analyzes measurements of privatization. Finally, I review the other causes of inequality included in the models, as well as their main findings.

Country and Year Choice

This section will survey country and year choices made in the literature. As stated earlier, a transition economy is defined as an economy that has recently changed from a centrally planned economy to a market one. An inequality study could potentially include all transition economies; however, this is not common in the literature due

to data restrictions and the greater ease of cross-comparison within similar groupings of countries. Additionally, the time period of focus is a key aspect of transition economy studies—eight Eastern European countries are thought to have “completed” their transitions in 2004 by joining the European Union, while others are considered not completely transitioned. Thus, the literature on these two aspects of transition economies—country and year choice—will be presented here.

Kornai (2006) looks at just the eight countries that are now members of the EU when analyzing the success of the transition. When discussing the possibility of investigating the wide range of countries considered to have begun transitions shortly after 1990, Kornai explains that he “would not dare to attempt to review this entire area in this paper, if for no other reason than—that primarily from the standpoint of their political structures—there are huge differences among the individual countries” (page 208). This is an important point to consider when selecting countries for transition economy studies; there are a wide variety of initial conditions faced by Eastern European transition economies. While all transition economies implemented roughly the same liberal policy package, (“The Washington Consensus”), designed to make use of market mechanisms (De Macedo and Martins, 2006), there were a broad range of initial conditions, which, combined with variances in the implementation of the policy package (i.e., different methods of privatization), contributed to a wide range of success amongst the countries (for more on this policy package, see Appendix 2, page 68).

Focusing only on the eight countries that joined the EU in 2004 (Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovak Republic, and Slovenia) would put the countries on a more similar platform to be evaluated. Kornai's study is unique because it is a historical analysis ar-

guing the relative success of the transition, using data as far back as the 1950s. He even places the transition in greater view of multiple centuries of various transitions. Historical background such as this is helpful for describing the initial conditions of the country, but will be less of a focus in this inequality study.

Although De Macedo and Martins (2006) also discuss the importance of initial circumstances on the results of a country's transition, they look at a broad range of 27 countries—the widest group in this literature. Data for all of the countries was found in the EBRD's Transition Reports over a variety of years. The years of their study are 1989–2004, from the beginning of the transition to the eight countries' joining of the union. De Macedo and Martins state that this time period essentially represents a complete policy cycle (i.e., enough time to see the effects of policies enacted at the beginning). They also separate the countries into three regional groups—New EU, Non-EU, and New Independent States of the Soviet Union. This helps distinguish groupings of countries based on initial conditions discussed above.

Barlow, Grimalda, and Meschi (2009) similarly group their 20 countries of interest into EU New Member states and Commonwealth of Independent States (CIS)/South-East European states groups. Their period of study is similar to De Macedo and Martins' as well, focusing on 1990–2004. Brixiova and Egert (2007) also group the countries into CEE (Central and Eastern Europe) and non-oil producing CIS countries, making this comparison the focus of the analysis up to 2007. Bennett, Estrin, and Urga (2007) study 23 countries, from 1990–2003, and group them instead by the three types of privatization method, the focal independent variables of the analysis. Their choice of countries was based on the transition countries listed in 2004 by the EBRD, but they exclude five countries for which data are not consistent.

Estrin (2006) also uses EBRD data, but for just 25 countries. Using a cross-section of employment and GDP indicators from 1991 (beginning), 1995 (middle), and 2001 (near-end), Estrin discusses the achievements of transition across these three key points in time, rather than looking at time series data throughout the entire period. This is helpful for providing key statistics to demonstrate milestones, but annual data throughout transition will be crucial to determine the effect of transition method in my analysis.

Measurements of Inequality and Data Sources

There are many ways to measure inequality, and different works in the literature use different methods. The Gini coefficient, described by Gini (1912), is a commonly used measurement because it provides a single statistical metric which captures a complete distribution (for a definition of its calculation, see Appendix 1, page 36). It is useful for this study because it assigns a single value to any country at any time, allowing for both cross-country and cross-time comparisons. Sometimes other measurements of inequality are used, since Gini coefficient data can be difficult to obtain. Statistics that state what percent of a country's income the top x percent holds are commonly referenced, but these represent only a small part of the distribution. Another statistic often used when discussing inequality is the percent of a country's population living below the minimum subsistence level, or poverty line. This is useful for demonstrating changes in standard of living, but does not provide insight into the distribution of income. These different statistics used in the literature, and their sources, are surveyed in this section.

Barlow, Grimalda, and Meschi (2009) use the Gini coefficient to measure income inequality. The sources for their inequality data are the WIDER-WIID, or World Income Inequality Database, developed by

WIDER, the World Institute for Development Economic Research. The authors also use data from the Estimated Household Income Inequality data sets, demonstrating the lack of availability of a comprehensive data set of income inequality figures.

Instead of using empirical data, Brixiova and Egert (2007) employ a theoretical model of the effect of market reforms on private sector growth, employment, and income distribution. While they do not actually apply their analysis to real data, they do use both the World Bank's World Development Indicators, as well as EBRD Transition Indicators, like Bennet, Estrin, and Urga (2007), for descriptive statistics.

Focusing instead on share of the economy held per person, Kornai (2006) uses the growth rate of GDP per capita, from the Organization for Economic Cooperation and Development (OECD) databases, to depict living standards over time. Like Barlow, Grimalda, and Meschi (2009), Kornai also presents Gini coefficient data at three key periods: pre-transition (1987–89), mid-transition (1996–97) and post-transition (2001–02). Ratios of the share of wealth held by the richest 10% to the poorest 10%, as well as by the richest 20% to the poorest 20%, are also presented for discussion, but not used in any analysis.

De Macedo and Martins (2006) do not look at inequality in particular, but do investigate interesting reform indicators in their discussion of positive policy linkages. They use the EBRD reform indicators: large-scale privatization, small-scale privatization, government and enterprise restructuring, price liberalization, trade and foreign exchange system, competition policy, banking, reform and interest rate liberalization, securities markets and non-bank financial institutions, and infrastructure. These reform indicators are similar to those used by Bennett, Estrin, and Urga (2007) to control various factors and isolate the effect of privatization method on growth of

the economy, and thus will be helpful in isolating the effects of privatization method on inequality in this study.

Incorporation of Privatization and Results

Most of the literature concerning transition economies does not discuss methods of privatization. However, as the focus of this paper, privatization methods' incorporation in the literature, where present, is discussed in this section.

Bennet, Estrin, and Urga (2007) evaluate how different privatization methods affected economic growth. They use the EBRD's categorization of the countries into three methods: voucher, sale, and MEBO. Regressing a privatization method dummy variable, along with many control factors, against GDP, they demonstrate a significant growth rate in countries that use the voucher method, but do not find accelerated growth in countries that used privatization by sale or by MEBO for their transition. While the voucher method of privatization is demonstrated to accelerate the growth rate most, other literature demonstrates skepticism towards this method, because it leads to highly dispersed ownership that can cause weak corporate governance (Johnson et al., 2000). Bennet, Estrin, and Urga counter such discussion with an argument for voucher use based on its speed of implementation, immediate rupture in state and enterprise sectors, and facilitation of a rapid evolution of ownership structure, in which the most effective managers hold enterprises.

Instead of looking at these privatization methods, Barlow, Grimalda, and Meschi (2009) analyze privatization in terms of small-scale versus large-scale, (i.e., privatization of small shops versus large enterprises), as they investigate the root causes of income inequality and GDP growth. Their model includes privatization as well as other institutional variables, e.g., price

liberalization. They show a significant positive correlation between inequality and both the small- and large-scale privatization indices. Export liberalization reduces inequality when combined with small-scale privatization, but not large-scale, leading to the conclusion that small-scale privatization is more effective at breaking the existing concentrated industrial structure. Barlow, Grimalda, and Meschi show that high levels of imports reduce income inequality during privatization because competition from imports is a means to counter monopoly power (thus reducing the adverse effects of privatization). Globalization is shown to moderate the effects of price liberalization, particularly through exports, and to even reduce the adverse effects of privatization.

Brixiova and Egert (2007) focus on the effects of privatization on private enterprise, modeling the relationship between the business environment and the development of productive private firms in transition economies. They focus more on general business climate than method of privatization, but the two are inherently linked. The macroeconomic variables used in the model are employment, output, labor productivity, private sector growth, and income distribution. Brixiova and Egert show that CEE countries adapted to structural reforms more swiftly and aggressively than CIS countries. The CEE's swifter implementation of market reforms, coupled with a better business environment, stimulated earlier adoption of new technologies and creation of highly productive private firms. They reinforce this with data, demonstrating that while the two groups had comparable private sector shares of the economy, CIS countries had fewer small- and medium-sized enterprises than CEE countries.

Estrin (2006) similarly focuses on employment levels and private-sector share of employment as measurements of transition. In addition to general discussion of countries' share of private enterprise over time, he also presents two main factors that influ-

ence whether privatization enhances private performance: the characteristics of the new owners (foreign being the most successful at enhancing enterprise performance), and the institutional and business environment (i.e., existence of property rights). He argues that the deficiencies of governance and institutions can usually be traced back to the methods of privatization used, and then cites Bennett, Estrin, and Urga (2007) in regard to the particular effects of privatization methods.

Kornai (2006) performs a historical analysis to argue that the recent Eastern European transition was relatively successful compared with other transitions in history. He bases this argument on the following important characteristics of transformation: it followed the global trend towards capitalism, it was a complete transition, it was non-violent and peaceful, and it occurred swiftly. He contrasts the transition in these regards to China's transition after Mao Zedong. In spite of the success of the Eastern Europe transition, Kornai realizes and discusses the everyday problems that came out of the transition, particularly income inequality, job security, and corruption. The main focus of this paper is the last mentioned factor of a successful transition—speed. This relates back to Bennett, Estrin, and Urga (2007)'s argument that voucher privatization caused the most swift transition and rapid devolution of state ownership structures.

Main Causes of Inequality

Similar to the existence of a variety of means of analyzing privatization, the literature takes many different approaches to modeling inequality and what determines it. Here, I will examine the factors that the literature considers necessary to include in an analysis of inequality in order to later support reasoning behind my choice of control factors.

Barlow, Grimalda, and Meschi's (2009)

work is a relevant piece of literature in regard to their inclusion of income inequality. The authors regress the Gini coefficient on globalization variables (imports, exports, and foreign direct investment), institutional variables (privatization and price liberalization), control variables, and a time trend on inequality. They find that price liberalization has the strongest effect on income inequality. Bennett, Estrin, and Urga (2007) perform a similar regression but instead regress variables against growth, not inequality. These variables include growth of capital, employment, human capital, privatization, capital market development, and the scale of the private sector. As discussed above, voucher privatization is always significant in causing growth in GDP. While Bennett, Estrin, and Urga's study is less focused on inequality, I will follow its general methods and note similar variables in terms of how they work with privatization to affect inequality.

A general discussion of how privatization affected levels of income inequality in transition economies can be found in Kornai (2006). He attributes most of this to structural unemployment, which he deems an inescapable aspect of transition. Open unemployment was unknown in the socialist economy, and everyone had job security. However, in the post-transition capitalist system, companies would often appear and then disappear, creating unemployment that most citizens had never experienced. Additionally, people weren't knowledgeable about price fluctuations, interest rates, and floating exchange rates—issues Kornai felt most strongly affected income inequality. For example, rapid inflation in many transition countries quickly eroded the value of pensions.

Gustafsson and Nivorozhkina (2005) model actual changes in income inequality, though only by looking at a specific region of Russia. The Gini coefficient in the survey data increased from 22.0 to 38.2 between 1989 and 2000. A general finding is that

an abrupt increase in income inequality from 1992 to 1993 occurred, after which only marginal changes occurred. To analyze the forces behind the increase in income inequality, the authors decompose the change in the Gini coefficient by five income components: earnings from a work contract of self-employment, public transfers, entitlement allowances, subsidiary production for home consumption, and private transfers. The relative shares of these categories are compared across the two time periods to demonstrate changes in the structure of income. The authors conclude that the expansion of public transfers and allowances contributed to increased inequality, while subsidiary income, (i.e., from black market transactions), was inequality-reducing. This refers again to the necessity of looking at both income and consumption inequality, though this is rare in the literature, since consumption inequality contains information about how such public transfer programs affect inequality.

One study which does discuss both income and consumption inequality is Leigh (2007). He takes a different approach and focuses on the role of minimum wage policies in affecting inequality, because instituting a minimum wage raises the wages of unskilled workers. Leigh explains that an increase in minimum wage increases not only income equality but also standard of living among wage earners, because it basically truncates the bottom of the distribution. Furthermore, he argues that an increase in the minimum wage also decreases employment and thus increases income inequality on the whole. His conclusion is that the firing of employees (reduced employment due to high labor costs) affects income distribution far more than modest wage increases of those who remain employed, and the minimum wage is thus a counter-productive tool in fighting income inequality.

Another factor affecting income inequality in transition economies is educa-

tion, as discussed by Keane and Prasad (2001). After the transition to capitalism, the financial return to education and experience increased dramatically, increasing labor earnings inequality, which had been artificially depressed during Soviet times. Inequality also increased due to sudden job destruction, which would affect income inequality in a similar manner to minimum wage policies, as discussed above. The authors claim that Poland avoided this massive increase in consumption inequality by implementing sizable pension plans and other successful social transfers at the onset of transition (though this should be understood with the fact that Poland, unlike the former Soviet states, never collectivized land). These are social explanations, and should be evaluated alongside privatization methods in terms of their effect on changes in income and consumption inequality.

While all of these studies bring up important factors to consider, Kaasa (2003) provides the most comprehensive overview of factors affecting income inequality. Kaasa organizes all of the factors thought to affect inequality in transition economies into five categories: (1) economic growth and overall development level of a country, (2) macro-economic factors, (3) demographic factors, (4) political factors, and (5) historical, cultural, and natural factors. A myriad of variables lies within each of these categories. Addressing the particular effects of each of these variables lies outside of the scope of this paper, but the variables are important to address in order to isolate the effects of the transition methods on inequality. For more on this, see Section 4: Multiple Regression Equation.

Data and Descriptive Statistics

Selection of Countries

This paper concerns all transition economies of Eastern Europe for which

sufficient data can be obtained for the decade following the year of their transitions. A complete listing of transition countries located in Eastern and Central Europe, their transition methods, and their year of privatization is provided in Table 1. Except where noted, all countries in Table 1 are included in analysis.

Further Country Categorization

After initial analysis, the empirical method will also be applied to different groupings of the countries to see if results are stronger for certain categories of countries. De Macedo and Martins (2006) separated the transition economies into three regional groups—New European Union (NWEU), Non-European Union (NEU), and New Independent States of the Soviet Union (NIS, also known as “Former Soviet Republics” or “Post-Soviet States”). Instead of labeling each country as one of these three groups, I will instead separate by two factors: whether or not the country was a member of the Soviet Union, and whether or not the country eventually became a member of the European Union. See Table 1 for these country identifications.

The purpose of the NIS/non-NIS classification is to help distinguish groupings based on initial conditions. While all transition economies were offered roughly the same liberal policy package designed to make use of market mechanisms, (see Appendix 2, page 37), there were a broad range of initial conditions. These initial conditions, combined with differences in the implementation of the policy package, contributed to a wide range of outcomes, as well as differences in levels of income and consumption inequality, for these countries.

The New EU/non-EU classification groups countries together based on final conditions, rather than initial. I hypothesize that final political conditions will be less of a differentiating factor between

inequality measurements than initial conditions. Unlike De Macedo and Martins (2006), countries that joined the EU after 2004, which include Bulgaria and Romania, both of which joined in 2007, will be labeled New EU here.

Measuring Inequality and Living Standards

There are many ways to measure inequality, but the Gini coefficient is one of the most effective because it captures the whole distribution of inequality in a country. It is a useful measurement in this context because, as previously stated, it assigns a single numerical value to a country at any time, allowing for both cross-country and cross-time comparisons (for an explanation of the Gini coefficient, see Appendix 1, page 36).

The Gini coefficient can refer to income inequality or consumption inequality. When analyzing a Gini coefficient data set, it is important to consider both the measurement: income, consumption/expenditure, or earnings, as well as the unit of analysis: household, family, or individual person, to ensure comparable data. There is no single source of Gini coefficient data that spans the years and countries in this study. Thus, I used data from four major sources: Measuring Income Inequality Database (under the World Bank), the Trans-MONEE Database, the World Bank World Development Indicators Database, and the World Income Inequality Database (WIID, under United Nations University). (For more on this data collection method, see Appendix 3, page 37.)

Though the Gini coefficient is a useful statistic for analyzing the distribution of income or consumption in a society, other measurements are better for analyzing living standards. For descriptive statistics on living standards in Eastern European transition economies, see Figure 1, in which average final annual consumption expen-

diture per capita is shown through the 1990s, organized by privatization method. Figure 1 shows that countries that used sale and MEBO privatization had significantly higher living standards than countries that used the voucher method. All countries experienced marked increase in consumption following 1994. This demonstrates that countries that used different privatization methods faced different initial economic conditions, though all countries saw real consumption increase after privatization.

Income and Consumption Inequality

Consumption inequality figures portray more equality among countries than income inequality figures because, at the lowest levels of income, consumption is usually higher than income, made possible by social programs or credit. Furthermore, consumption is usually smaller than income at higher income levels, because of higher savings rates. Thus, income inequality demonstrates a larger spread, while consumption inequality purports a smaller range of inequality among countries.

Table 2 provides Gini coefficient data on income and consumption inequality in 1997 for the transition economies, as well as for the US as a comparison. This year is a crucial year in transition—at this point, most of the transition countries had begun their transition. This time also comes just before the Russian financial crisis of 1998, which had massive effects on all of the former Soviet states and other countries in the area. Armenia, Azerbaijan, Georgia, and Romania had the highest levels of income inequality in 1997, with Romania having the highest at 61. Belarus had the lowest income inequality, at 25, (even though Belarus’ transition began in 1994, it is considered to have exhibited one of the least overhauling transitions). Two-thirds of the countries had more income inequality (higher Gini coefficients) than the US at this time.

Country	Income Gini Coefficient	Consumption Gini Coefficient
1 Albania	43	29
2 Armenia	56	41
3 Azerbaijan	49	35
4 Belarus	25	26
5 Bosnia & Herzegovina	n.a.	24
6 Bulgaria	43	26
7 Croatia	38	26
8 Czech Republic	34	25
9 Estonia	36	37
10 Georgia	51	36
11 Hungary	40	27
12 Kazakhstan	n.a.	35
13 Kyrgyz Republic	45	42
14 Latvia	39	32
15 Lithuania	40	34
16 Macedonia, FYR	43	34
17 Moldova	41	37
18 Poland	37	33
19 Romania	61	29
20 Russian Federation	42	34
21 Slovak Republic	37	24
22 Slovenia	34	28
23 Tajikistan	n.a.	31
24 Turkmenistan	n.a.	40
25 Ukraine	42	33
26 Uzbekistan	n.a.	47
United States of America	38	n.a.

Table 2. Gini Coefficients for Income and Consumption Inequality in 1997

Sources: UNICEF IRC TransMONEE 2008 Database, UNU-WIDER WIID 2008, World Bank Development Indicators 2011

The Gini coefficients for consumption inequality are considerably lower than for

income inequality. Additionally, the range of consumption inequality levels in the transition economies is smaller than that of income inequality—24 to 47 versus 25

Country Group	Pre-Transition 1987-89	Mid-Transition 1996-97	Post-Transition 2001-02	Percent Change Pre to Post
CEE 8	23.8	28.9	30.9	29%
EU 15	26.9	27.8	28.6	7%

Table 3. Consumption Gini Coefficient for CEE 8 with EU 15 as a Comparison

Sources: Measuring Income Inequality Database 1996, UNU-WIDER WIID 2008, World Bank Development Indicators 2011

Note: CEE refers to Central and Eastern Europe; EU refers to the European Union

to 61. Bosnia & Herzegovina and Slovak Republic had the lowest levels of consumption inequality, while Uzbekistan had the highest. Krueger and Perri (2006) advocate looking at consumption inequality instead of income inequality to more accurately depict changes in welfare. Consumption inequality also accounts for the degree of flexibility in credit markets—at different points in life, people earn less or more income, but they smooth their consumption over their life with the use of credit markets. Additionally, consumption inequality represents the effects of redistributive policies in a society.

Table 3 presents the average consumption Gini coefficient for the eight CEE and the fifteen EU countries at different key points in development. From pre- to post-transition, the CEE 8's Gini coefficient rose from 23.8 to 30.9, while the EU 15's Gini coefficient rose from 26.9 to 28.6, representing 29% and 7% increases, respectively. Thus, the CEE countries started off more equal than the EU countries and became more unequal following the transition. The transition from a communist society exhibiting mass equality due to socialist political structures, to a capitalist society with market mechanisms, caused more inequality in Eastern Europe than in European Union countries (though this group of countries includes some transition economies as well).

Figures 2A and 2B present average income and consumption Gini coefficient trends, grouped by privatization method, from 1992 to 2002. Income inequality rose on average for countries using any method during the period of 1992 to 1995, and then settled into a smaller range, between 37 and 43 on average. After 1994, income inequality in voucher countries was always higher than in sales countries, which was always higher than MEBO countries, on average. This pattern is similar for consumption inequality, however, voucher countries started out significantly less equal than sale and MEBO countries, though all three groupings of countries merged towards a Gini coefficient between 30 and 35.

Multiple Regression Equation

The following basic conceptual equation will guide my methodology for determining the effect of privatization method on changes in inequality:

$$\% \Delta GINI_{it} = \beta_0 + \beta_1 SALE_{it} + \beta_2 VOUCHER_{it} + \beta_3 MEBO_{it} + \varepsilon_{it}$$

The equation employs three time-specific dummy variables, SALE, VOUCHER, and MEBO, each taking the value of zero (0) in the years prior to privatization, and the value of unity (1) in the year of privatization and subsequent years, in countries that adopted sale, voucher, and MEBO

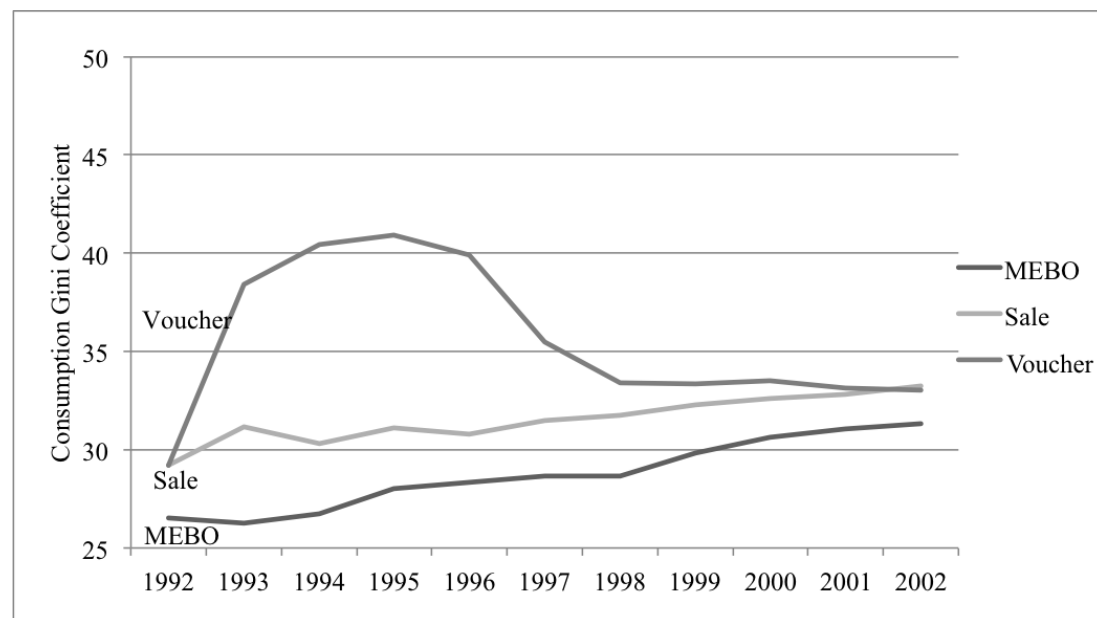


Figure 2A. Income Inequality Trends by Privatization Method

Source: EBRD 1999 Transition Report, Measuring Income Inequality Database 1996, UNICEF IRC TransMONEE 2008 Database, UNU-WIDER WIID 2008, World Bank Development Indicators 2011

privatization methods, respectively. These variables are analyzed in terms of their effects on the dependent variable, $\% \Delta GINI_{it}$, a measurement of the change in income or consumption inequality on country i at time t over the previous year. The error term, ε_{it} , captures all other factors that influence the dependent variable other than the independent variables.

There are a variety of other factors that contribute to a country's level of inequality and must be controlled for to determine the effects of the privatization methods. These factors must be considered carefully because, according to Kaasa (2003), "The direction of these influences [of factors affecting inequality], however, is often unclear: whether a higher value of a certain factor causes higher or lower inequality depends on the characteristics of the economic system and the overall level of development of the country," (page 11). Kaasa system-

atized factors affecting income inequality into five groups: (1) economic growth and overall development level of a country, (2) macroeconomic factors, (3) demographic factors, (4) political factors, and (5) historical, cultural, and natural factors. While it is impossible to control for all of these factors, I will attempt to control for the most significant ones, using Economist Intelligence Unit (EIU) Country Data and World Bank World Development Indicators data.

1. Economic growth and overall development

First, to address economic growth and overall development of a country, percentage change in real GDP per capita [$GDP_{PC_{it}}$] over previous year is added to the regression. Changes in the development of the structure of the economy must be addressed as well. As a country's workers move up to a higher sector (e.g., from agriculture

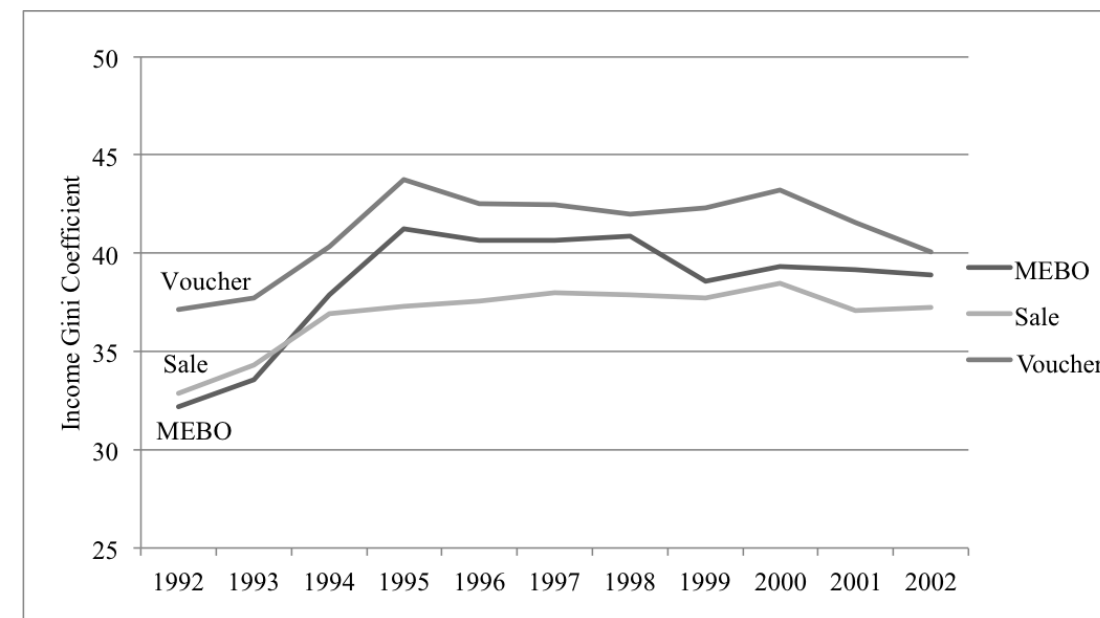


Figure 2B. Consumption Inequality Trends by Privatization Method

Source: EBRD 1999 Transition Report, Measuring Income Inequality Database 1996, UNICEF IRC TransMONEE 2008 Database, UNU-WIDER WIID 2008, World Bank Development Indicators 2011

to manufacturing to services, due to technological change), income inequality tends to increase. Thus, percentage changes in real agriculture, manufacturing, and services, each in terms of value-added to the economy over the previous year, are added [$AGRICULTURE_{it}$, $MANUFACTURING_{it}$, and $SERVICES_{it}$].

2. Macroeconomic factors

Additionally I address macroeconomic factors. Inflation is included in the form of percentage change in Consumer Price Index over the previous year [CPI_{it}]. Official recorded unemployment as a percentage of labor force is included for unemployment [$UNEMPLOYMENT_{it}$]. Change in government consumption as a percentage of GDP over the previous year addresses the size of government [$GOVTCONS_{it}$]. Finally, total external debt as a percentage of GDP, as well as stock of foreign reserves, are

included to address debt issues [$DEBT_{it}$ and $FOREIGNRESERVES_{it}$].

3. Demographic factors

To address demographic figures, percentage change in mid-year population over previous year is included. According to Kaasa (2003) these factors include the age structure of the population, growth and density of population, urbanization, and level of human capital (level of education and health condition of population). Due to the high degree of correlation among these variables, I only include population [$POPULATION_{it}$].

4. Political factors

According to Kaasa, the main political factors affecting income inequality include the share of private vs. public sector, already addressed above with share of government

consumption, and the method of privatization used. Thus, no additional political factors are included.

5. Historical, cultural, and natural factors

Historical and cultural factors cannot be consistently accounted for as they include immeasurable things like people's attitudes toward income inequality and the extent of the shadow economy. Natural factors include geography and natural resources, thus, a country's annual oil rents, as a share of GDP [OILRENTS_{it}], are included to control for the disparity in natural resources.

Thus, the final equation is now:

$$\begin{aligned} \% \Delta GINI_{it} &= \beta_0 + \beta_1 SALE_{it} + \beta_2 VOUCHER_{it} \\ &+ \beta_3 MEBO_{it} + \beta_4 \% \Delta GDP_{it} \\ &+ \beta_5 \% \Delta AGRICULTURE_{it} \\ &+ \beta_6 \% \Delta MANUFACTURING_{it} \\ &+ \beta_7 \% \Delta SERVICES_{it} + \beta_8 \% \Delta CPI_{it} \\ &+ \beta_9 UNEMPLOYMENT_{it} \\ &+ \beta_{10} \% \Delta GOVTCONS_{it} + \beta_{11} DEBT_{it} \\ &+ \beta_{12} FOREIGNRESERVES_{it} \\ &+ \beta_{13} \% \Delta POPULATION_{it} \\ &+ \beta_{14} OILRENTS_{it} + \varepsilon_{it} \end{aligned}$$

In which:

SALE_{it} = Dummy variable for sale method of privatization

VOUCHER_{it} = Dummy variable for voucher method of privatization

MEBO_{it} = Dummy variable for MEBO method of privatization

GDP_{it} = GDP per capita

AGRICULTURE_{it} = Agriculture sector value-add

MANUFACTURING_{it} = Manufacturing sector value-add

SERVICES_{it} = Services sector value-add

CPI_{it} = Consumer Price Index

UNEMPLOYMENT_{it} = Unemployment as a percent of labor force

GOVTCONS_{it} = Government consumption as a percentage of GDP

DEBT_{it} = Total external debt as a percentage of GDP

FOREIGNRESERVES_{it} = Stock of foreign reserves

POPULATION_{it} = Mid-year population

OILRENTS_{it} = Oil rents as a share of GDP

ε_{it} = Error term

Many of these factors are likely to be correlated to one another, raising the issue of collinearity in the analysis. I use principal component analysis (PCA) to reduce the data set and draw a large number of variables together to form only a few factors. The set of initial variables is organized so that groups of closely related indicators, "components," are determined. I then use factor analysis to determine which factors compose the majority of the main components to determine which factors most explain variance in the data set. I then proceed to study the effects of privatization method, while controlling for these primary factors only. After these analyses, I find values for the coefficients β_1 , β_2 and β_3 , representing the effect of sale, voucher, and MEBO methods of privatization, respectively, on the Gini coefficient of the transition countries.

Analysis of Results

Initial Analysis of the Decade Following Privatization

First, the basic data is examined in the form of all available Gini coefficient data from the years 1990-2004 (dates widely considered the start and end of Eastern Eu-

Country	Privatization Method	Percent Change in Gini Coefficient, 10 Years After Privatization
Belarus	MEBO	-24.1
Kyrgyz Republic	Voucher	-19.7
Georgia	Voucher	-17.2
Macedonia, FYR	MEBO	-16.2
Slovak Republic	Sale	-14.5
Czech Republic	Voucher	-14.2
Albania	MEBO	-13.1
Ukraine	Voucher	-13.1
Moldova	Voucher	-8.3
Lithuania	Voucher	-7.8
Slovenia	MEBO	-7.6
Estonia	Sale	1.8
Russian Federation	Voucher	10.3
Kazakhstan	Sale	13.1
Bulgaria	Sale	13.3
Latvia	Sale	15.6
Hungary	Sale	22.0
Poland	Sale	24.6
Armenia	Voucher	35.3
Croatia	MEBO	38.1
Romania	MEBO	113.2

Table 4A. Percentage Change in Income Gini Coefficient in the Decade Following Privatization

Source: ERBD 1999 Transition Report, Measuring Income Inequality Database 1996, UNICEF IRC TransMONEE 2008 Database, UNU-WIDER WIID 2008

Note: Azerbaijan, Bosnia & Herzegovina, Tajikistan, Turkmenistan and Uzbekistan excluded due to data unavailability

ropean transition). Based on initial descriptive statistics, the voucher method appears to be associated with the highest levels of income inequality. With Bennet, Estrin, and Urga's 2006 findings that the voucher method was associated with the largest increase in GDP, this implies an association with income inequality and GDP growth, as discussed in Section 1.

While the voucher method is associated with the highest levels of the Gini coefficient looking at all data, one sees a different trend when looking at percentage change in consumption inequality through the decade following privatization. When looking at the change in the level of the Gini coefficient between the year immediately following privatization, and ten years fol-

Country	Privatization Method	Percent Change in Gini Coefficient, 10 Years After Privatization
<i>Kyrgyz Republic</i>	<i>Voucher</i>	-46.2
<i>Armenia</i>	<i>Voucher</i>	-34.7
<i>Ukraine</i>	<i>Voucher</i>	-31.4
<i>Russian Federation</i>	<i>Voucher</i>	-24.9
<i>Lithuania</i>	<i>Voucher</i>	-12.9
<i>Estonia</i>	<i>Sale</i>	-9.4
<i>Kazakhstan</i>	<i>Sale</i>	-1.3
<i>Hungary</i>	<i>Sale</i>	0.1
<i>Moldova</i>	<i>Voucher</i>	0.9
<i>Bulgaria</i>	<i>Sale</i>	6.1
<i>Georgia</i>	<i>Voucher</i>	6.9
<i>Czech Republic</i>	<i>Voucher</i>	8.4
<i>Tajikistan</i>	<i>Sale</i>	8.5
<i>Slovenia</i>	<i>MEBO</i>	9.1
<i>Croatia</i>	<i>MEBO</i>	10.8
<i>Albania</i>	<i>MEBO</i>	12.0
<i>Belarus</i>	<i>MEBO</i>	13.3
<i>Poland</i>	<i>Sale</i>	16.4
<i>Romania</i>	<i>MEBO</i>	23.6
<i>Macedonia, FYR</i>	<i>MEBO</i>	43.2
<i>Latvia</i>	<i>Sale</i>	43.7

Table 4B. Percentage Change in Consumption Gini Coefficient in the Decade Following Privatization

Source: ERBD 1999 Transition Report, Measuring Income Inequality Database 1996, UNU-WIDER WIID 2008, World Bank Development Indicators 2011

Note: Azerbaijan, Bosnia & Herzegovina, Slovak Republic, Turkmenistan and Uzbekistan excluded due to data unavailability

lowing privatization, the voucher method was associated with a decrease in the Gini coefficient (i.e., an increase in equality) for all countries that used it, except for Moldova, Georgia, and Czech Republic. Tables 4A and 4B list the countries in order of percent change in income and consumption Gini coefficient, respectively, over this time

period. Countries excluded in these tables, due to data unavailability, include: Azerbaijan, Bosnia & Herzegovina, Turkmenistan and Uzbekistan. Additionally, Slovak Republic is excluded only from consumption inequality data, and Tajikistan is excluded only from income inequality data.

Table 4A demonstrates a more mixed pattern among countries' changes in levels of income inequality than those in Table 4B for consumption inequality. While more countries saw income inequality decreases than increases, eleven countries vs. ten countries, the income inequality decreases were much smaller in magnitude than consumption decreases. Romania, a country that used the MEBO method, stands out as having the largest increase in income inequality. However, Belarus saw the largest decrease in income inequality and also used the MEBO method. In general, voucher countries were more likely to see a decrease in income inequality and sale countries were more likely to see an increase.

Why was the voucher method associated with the highest initial levels of consumption inequality? The consumption Gini coefficients for this set of countries were shown in Figures 2A and 2B. The voucher method was applied to countries with the highest levels of consumption (and income) inequality at the start of privatization, and the lowest levels of expenditure per capita (see Figure 1). The countries with lower levels of inequality at the onset of transition used the MEBO and sale methods. Thus, it should be noted that the methods were not randomly assigned and thus cannot be considered treatments—there is simultaneity in the choice of method and the level of inequality.

All of the transition economies experienced the most extreme changes in Gini coefficient levels during the first five years of the transition, and then exhibited little change in the latter half of the decade, as shown in Figures 2A and 2B. After a decade, the levels of consumption inequality appear to have stabilized. This stabilization of consumption inequality may be evidence of the Kuznets Curve phenomenon—the hypothesis of Kuznets (1955) that economic inequality increases over time while a country is developing, and then once a certain average income is attained, inequality begins to

decrease. According to this hypothesis, it is possible that the countries that saw marked increases in their Gini coefficients, followed by more recent steady trends, may be at the top of the Kuznets Curve, and will soon see inequality decrease again. (For more on the Kuznets Curve, see Appendix 4, page 38.)

Multiple Regression Results

The effects of privatization methods on the annual percentage changes in income and consumption inequality, as determined by the multiple regression analysis, are shown in Tables 5 and 6, respectively. (As in Tables 4A and 4B, countries excluded from the regression include: Azerbaijan, Bosnia & Herzegovina, Turkmenistan and Uzbekistan; as well as Slovak Republic from consumption inequality and Tajikistan from income inequality.)

To determine which of the aforementioned control variables most affected inequality, I first conducted principal component analysis to determine which factors explained most of the variance in the data. These factors are: changes in each of manufacturing, agriculture, and services value-added, stock of foreign reserves, oil rents, and growth in GDP. Four forms of the regression equation were conducted. In form (1), only the three privatization methods were regressed against the Gini coefficient. In form (2), changes in each of manufacturing, agriculture, and services value-added are added as control variables. In form (3), stock of foreign reserves and oil rents are added. And finally, in form (4), growth in GDP is also controlled for.

In all four forms of the equation, none of the privatization methods or other factors had significant effects on changes in income inequality. The voucher method was associated with an average 0.41% decrease in Gini coefficient, while the sale and MEBO methods were associated with increases of 1.06% and 1.41% respectively.

	β			
	(1)	(2)	(3)	(4)
Voucher	-0.41 (1.04)	-0.53 (1.86)	-0.31 (1.98)	-1.49 (2.22)
Sale	1.06 (1.11)	-0.16 (2.41)	0.28 (2.71)	-1.03 (2.94)
MEBO	1.41 (1.20)	0.79 (1.64)	0.77 (1.79)	-0.04 (1.92)
Δ Agriculture Value-Add		0.02 (0.13)	0.02 (0.13)	0.01 (0.13)
Δ Manufacturing Value-Add		0.06 (0.11)	0.06 (0.11)	-0.02 (0.13)
Δ Services Value-Add		0.00 (0.14)	-0.01 (0.15)	0.01 (0.15)
Stock of Foreign Reserves			-0.06 (0.16)	-0.03 (0.17)
Oil Rents as a Share of GDP			0.15 (0.94)	-0.02 (0.95)
Growth in GDP				0.33 (0.28)
Adjusted R ²	0.00	-0.04	-0.06	-0.06

Table 5. Multiple Regression Results: Variables Regressed Against Income Gini Coefficient
Standard errors are presented in parentheses
No figures are significant at the 10% level

The privatization methods had similar, but more significant effects on changes in consumption inequality. In the first-form equation, with no control variables, the voucher method was associated with a 1.80% average decrease in consumption inequality, significant at the 5% level. The sale method was associated with a 1.02% annual increase and the MEBO method with a 1.85% annual increase, with only the MEBO having a significant increase.

As more controls are added to the regression, the magnitude of the effect of the voucher method on reducing consump-

tion inequality increases, as well as its significance. The effect of the sale method at increasing consumption inequality is significant at the 10% level only in the second-form equation, while the MEBO method's effect on increasing consumption inequality remained significant in all forms of the equation. Additionally, the change in the value-add of the manufacturing sector had a significant effect on consumption inequality in all three forms of the equation for which it was included. A 1% percent increase in the manufacturing value-add was associated with a 0.14% decrease in consumption inequality. Thus, manufac-

	β			
	(1)	(2)	(3)	(4)
Voucher	-1.80** (0.77)	-2.66*** (0.92)	-2.92*** (0.97)	-3.28*** (1.10)
Sale	1.02 (0.83)	1.96* (1.04)	1.67 (1.12)	1.22 (1.28)
MEBO	1.85** (0.89)	2.14*** (0.81)	2.07** (0.88)	1.83* (0.95)
Δ Agriculture Value-Add		-0.05 (0.06)	-0.04 (0.06)	-0.04 (0.06)
Δ Manufacturing Value-Add		-0.14*** (0.05)	-0.14*** (0.05)	-0.17*** (0.06)
Δ Services Value-Add		0.11 (0.07)	0.11 (0.07)	0.11 (0.07)
Stock of Foreign Reserves			0.05 (0.08)	0.06 (0.08)
Oil Rents as a Share of GDP			-0.04 (0.45)	-0.10 (0.46)
Growth in Real GDP				0.10 (0.14)
Adjusted R ²	0.04	0.14	0.13	0.13

Table 6. Multiple Regression Results: Variables Regressed Against Consumption Gini Coefficient
Standard errors are presented in parentheses

*Denotes statistical significance at the 10% level

**Denotes statistical significance at the 5% level

***Denotes statistical significance at the 1% level

turing is associated with more consumption equality in a society, perhaps reflective of a strong middle class.

Comparing NIS with Others

As discussed above, the voucher method was applied to the countries with the highest levels of initial consumption inequality. The next question to be addressed is whether the implementation of the voucher method caused the reduction in inequality, or simply the convergence of inequality

levels in Eastern Europe did so. Eight of the ten transition economies that used the voucher privatization method are former members of the Soviet Union (i.e., NIS countries). Additionally, as shown in figures 2A and 2B, voucher countries had higher levels of income and consumption inequality in 1994, when they transitioned on average, than other countries did. Whether NIS countries were prescribed the voucher method due to former-Soviet status or due to initially high levels of inequality is hard to determine.

In the multiple regression equation, the effects of the privatization methods on income inequality remained insignificant when looking at all NIS, or all non-NIS, countries grouped together. The effects of privatization method on consumption inequality in NIS countries, in the fourth-form equation, were similar but larger in magnitude to the results for all transition economies. The voucher method was associated with a 3.97% decrease, significant at the 1% level, and the MEBO method was associated with a 6.21% increase, significant at the 10% level. The effect of the sale method was insignificant but associated with a 1.4% increase. Amongst non-NIS countries, the voucher method had an insignificant effect, though was still consumption inequality reducing on average of 1.74%. The effect of the sale method was again insignificant, though the MEBO was associated with a 2.73% increase, significant at the 10% level. Thus, there were only changes in magnitudes and significance of the effects between NIS and non-NIS country groupings, but the direction of the influences remained the same.

Comparing EU with Others

Like for the NIS/non-NIS country groupings, the privatization methods still had insignificant effects on income inequality when looking at the countries in EU/non-EU groupings separately (in all forms of the equation). The one exception to this was a 4.64% increase in the income Gini coefficient, associated with the MEBO effect in the first-form equation, significant at the 5% level (but this is with no control variables).

In the multiple regression on the consumption Gini coefficient, the effects of privatization method on consumption inequality in EU countries, in the fourth-form equation, lost all significance. The effects on non-EU countries remained significant; the voucher method was associated with a 3.49% decrease in consumption

inequality, significant at the 10% level, and the MEBO method was associated with a 3.73% increase in consumption inequality, significant at the 5% level. Thus, we see that the results hold less for countries that eventually joined the EU than for other countries.

Conclusion

My analysis has shown that the use of the three different privatization methods in Eastern Europe had varying effects on changes in both income inequality and consumption inequality for the decade following transition.

The voucher method of privatization was associated with a reduction in both average annual percent change in consumption and income inequality for countries that used it, though the results were only significant for consumption inequality. This method was applied to countries with the highest initial levels of inequality, including many of the New Independent States, as well as to countries with lower standards of living throughout the 1990s. It is possible that this method enabled more of a spread of capital since shares of state enterprises were made available to all citizens.

Those countries where the sale method was used experienced a relatively small and insignificant change in income inequality, but a slightly significant increase in consumption inequality. This small effect may be explained by the fact that, in privatization by sale, shares of public enterprises were sold for a price; thus their distribution was correlated to initial income levels.

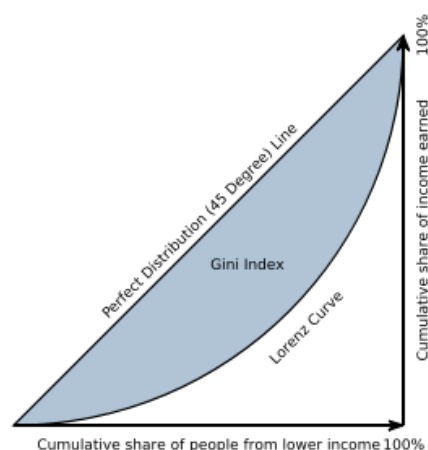
Finally, those countries that chose the management-employee buyout method saw a statistically significant increase in consumption inequality as well, though no significant effect on income inequality. In MEBO privatization only employees of the

firm, managerial and otherwise, could purchase the shares from the state, thus usually initially concentrating them in the hands of fewer people than other privatization methods would have. The results of the analysis here demonstrate that this inequality persisted throughout the decade following privatization as well.

These results indicate that privatization by voucher was associated with decreases in consumption inequality, and privatization by the sale and management-employee buyout methods were associated with increases. These effects are strongest for countries that are New Independent States which have not yet joined the European Union. The privatization methods were not associated with changes in income inequality. Consumption inequality is a better measure to analyze when studying transition economies, since increases in income inequality are usually accepted as necessary for growth, but increases in consumption inequality are not necessarily. A country can avoid massive increases in consumption inequality when transitioning if it successfully implements credit markets and welfare programs. Analysis of these results in conjunction with Bennett, Estrin, and Urga's (2007) finding that the voucher method was the only method to significantly increase GDP growth, leads me to conclude that the voucher was the most successful method of privatization used in Eastern European transition economies.

Appendix 1. Explanation of the Gini Coefficient

The Gini coefficient was first described by Corrado Gini in his 1912 article, "Variability and Mutability." The Gini coefficient is a statistical measurement of distribution, based on the Lorenz Curve (shown below), a graphical representation of the cumulative distribution function of the empirical distribution of wealth. It is a graph of the proportion of people in a society against the cumulative share of income earned by that proportion of people, and thus it incorporates a spectrum of commonly referenced figures of income inequality, like "the bottom X % of a population only hold <X % of the society's income." The Gini coefficient ranges from 0 to 1, where 0 represents complete equality (everyone has an equal share of the wealth), and 1 represents complete inequality (one person controls all of the wealth). It is commonly scaled linearly to a 0-100 range and referred to as the Gini index. The Gini coefficient can be found with integration: if the area between the line of perfect equality and the Lorenz Curve is A, and the area under the Curve is B, then the Gini coefficient is $A/(A+B)$. Since $A+B = 0.5$, the Gini coefficient, $G = A/(0.5) = 2A = 1-2B$. Thus, one can find the Gini coefficient using:



Appendix 2. The Washington Consensus

The Washington Consensus refers to an orientation of Neoliberal policies that was influential among mainstream economists from 1980-2008, and was supported by institutions like the IMF and the World Bank. This collection of policies was advocated for and implemented in emerging economies throughout this time. These policies included advice on reducing government deficits, liberalizing and deregulating international trade and cross border investment, and pursuing export led growth. The Washington Consensus received criticism in terms of its success in former-Soviet countries, since many of them had failed to achieve 1990 levels of output even a decade after transition. The Washington Consensus was dismissed as mainstream policy following the recent financial crisis. In 2010 the G20 endorsed the Seoul Development Consensus, which allows a larger role for state intervention and emphasizes tailoring policies to the requirements of the individual developing countries, rather than imposing a uniform, top-down solution.

Appendix 3. Notes on Gini coefficient Data Collection

There is no single source of Gini coefficient data that spans the years and countries in this study. Thus, I used data from four major sources: the Measuring Income Inequality Database (under the World Bank), the TransMONEE Database, the World Bank World Development Indicators Database, and the World Income Inequality Database (WIID, under United Nations University). The World Bank World Development Indicators formed the majority of the consumption Gini coefficient dataset, and was supplemented by the Measuring Income Inequality Database and WIID. The latter of these two references contained multiple Gini coefficient surveys, and grades of their accuracy. The TransMONEE Database formed the majority of the income Gini coefficient dataset, and

was also supplemented by the Measuring Income Inequality Database and WIID. Only data from household-level inequality studies were used.

Appendix 4. The Kuznets Curve

The Kuznets Curve is a graphical representation of Simon Kuznets's hypothesis, first described in his 1955 American Economic Review article, "Economic Growth and Income Inequality," that economic inequality increases over time while a country is developing, and then, after a certain average income is attained, decreases. One theory behind this is that in early stages of development, investment in physical capital is the main mechanism of economic growth, and inequality encourages growth by reallocating resources towards those who save and invest the most. At a later stage, once the economy is matured, human capital accrual takes the place of physical capital accrual as the main source of growth. At this point, inequality slows growth by lowering education standards because lower-income people cannot finance their education in imperfect credit markets. The Kuznets curve is now commonly used to describe other phenomenon, e.g., the relationship between income per capita and environmental degradation.



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