MICHIGAN
JOURNAL OF BUSINESS

VOLUME 1: ISSUE 2 APRIL 2008

The Michigan Journal of Business (ISSN# 1941-5745) is published semiannually by undergraduate business students on behalf of the Stephen M. Ross School of Business at the University of Michigan. Communication should be addressed to:

701 Tappan Street
Ann Arbor, MI 48109
Phone: 248-840-3518
E-mail: mjbquestions@umich.edu
Website: www.michiganjb.org

EDITORIAL OBJECTIVE: The Michigan Journal of Business intends to provide undergraduate students worldwide with a platform for exceptional work in the field of business. The Michigan Journal of Business seeks to publish distinguished theses, empirical research, case studies, and theories in issues relating to areas of Accounting, Economics, Finance, Marketing, Management, Operations Management, Information Systems, Business Law, Corporate Ethics, and Public Policy. The Journal is distributed and cataloged in prestigious university libraries around the world, and is enlisted in the Directories of Open Access Journals (DOAJ), a scholarly journal database that enlists more than 3000 of the world's leading publications. The contemporary business environment is exceedingly complex. Analyzing this real world phenomenon through traditional applications of theories often yield a suboptimal understanding of the world. The Journal, accordingly, encourages work that takes an interdisciplinary approach to understanding a topic and emphasizes the importance of incorporating the knowledge of liberal arts into an area of interest. By providing a venue to recognize high quality work, the Michigan Journal of Business gives an incentive for students to explore their area of interest, rewarding them with the experience to share the power of knowledge with others. The Journal's mission and philosophy parallels the mission of the University of Michigan, the premier research university in the United States.

CONTRIBUTOR INFORMATION: The Journal only accepts works from undergraduate students or works completed during undergraduate study. Each manuscript submitted should include a short abstract, author information, and any acknowledgements. Papers will be evaluated based upon sound analysis, originality of argument, and novelty of research. For more information on submitting article for publication, please visit www.michiganjb.org.

REVIEW PROCESS: The organization is entirely student-run, with an editorial staff of about fifteen of the top students at the Department of Economics and the Stephen M. Ross School of Business at the University of Michigan. Each semester, the Michigan Journal of Business calls for papers from undergraduate students around the world. Throughout the semester, the editorial board carefully reviews, selects, and edits exceptional work for publication. Faculty willing to advise the Journal is formed from each department to give minor oversight for the project. Throughout the process, a blind review process is implemented to ensure an impartial review of all submissions.

EDITORIAL BOARD

The editorial board is composed of the top undergraduate students at the Stephen M. Ross School of Business and the Department of Economics at the University of Michigan. They are selected through a competitive application process based on academic merit and aptitude in writing. This diverse group of students includes the Class Valedictorian, a future law student at the University of Michigan Law School, and summer interns at Morgan Stanley, Lehman Brothers, JPMorgan, Merrill Lynch, and Citigroup.

FACULTY SUPERVISION

The Journal is supervised by Professor Scott Moore, Arthur F. Thurnau Professor of Business Information Technology and BBA Program Director at the Ross School of Business. The following members of the Ross School of Business faculty also provide minor oversight to the editorial board during the review process:

Anocha Aribarg
Ph.D., University of Wisconsin
Assistant Professor of Marketing

George Cameron III
J.D., Ph.D., University of Michigan
Professor Emeritus of Business Law

David Hess
J.D., Iowa, Ph.D., University of Pennsylvania
Assistant Professor of Business Law and Business Ethics

Aneel G. Karnani
Ph.D., Harvard
Associate Professor of Strategy; Chair of Strategy

Scott A. Moore
Ph.D., University of Pennsylvania
Arthur F. Thurnau Professor; BBA Program Director; Associate Professor of Business Information Technology

Andrea Morrow
M.A., University of Michigan
Director of Writing Programs; Co-Coordinator BBA Communication Program

Dana M. Muir
J.D., University of Michigan
Arthur F. Thurnau Professor of Business Law

Anu Nagarajan
Ph.D., University of Michigan
Lecturer of Strategy

Lisa A. Pawlik
M.B.A., University of Michigan
Adjunct Lecturer of Business Communication; Co-Coordinator of BBA Communication Program

Josh Pierce
Ph.D., Michigan State University
Assistant Professor of Finance at University of South Carolina

Lloyd Sandelands
Ph.D., Northwestern
Professor of Management and Organizations & Professor of Psychology

Dennis G. Severance
Ph.D., University of Michigan
Accenture Professor of Business Info. Tech.

Amitabh Sinha
Ph.D., Carnegie Mellon University
Assistant Professor of Operations and Management Science

Valerie Y. Suslow
Ph.D., Stanford
Associate Dean for Degree Programs; Louis and Myrtle Moskowitz Research Professor of Business and Law; Associate Professor of Business Economics and Public Policy

David B. Wooten
Ph.D., University of Michigan
Associate Professor of Marketing

Lynn P. Wooten
Ph.D., University of Michigan
Clinical Assistant Professor of Strategy and Management & Organizations

CONTRIBUTING INSTITUTIONS

Submitted papers for this edition came from the following institutions:

Duke University
Harvard University
Indiana University – Bloomington
Massachusetts Institute of Technology
Middlebury College
New York University
Nottingham University, U.K.
Syracuse University
Tufts University
University of British Columbia, Canada
University of California – Berkeley
University of California – San Diego
University of Pennsylvania
University of Virginia
University of Wisconsin – Madison
Washington University in St. Louis
Yale University

(ISSN# 1941-5745)

Cover: "Building the Learning Community of the Future." Ross Community Creation Project. Estimated completion: Fall 2008. The architectural firm Kohn Pedersen Fox (KPF) has designed a new 270,000-square-foot structure that will provide an architectural presence, inside and out, befitting the Ross School's national stature. More importantly, plans for the proposed building affirm the school's commitment to create the learning community of the future: a community where faculty, students and corporate partners work together to create new knowledge and learn from each other.

MICHIGAN
JOURNAL OF BUSINESS

VOLUME 1: ISSUE 2 APRIL 2008

CONTENTS

8 From the Editors

11 Has the Euro Increased Trade?
DANNY MCGOWAN
University of Nottingham

53 The Coming Chinese Century: Boon or Bane for Southeast Asia?
GEOFFREY (KOK HENG) SEE
University of Pennsylvania

73 Greater Equivalency of High School Equivalents? A Study of GEDs and Their Effect on Labor Market Status
DIANA TREBINO
Middlebury College

87 The Effects of Excise Tax on Cigarette Consumption: A Divergence in the Behavior of Youth and Adults
SERGINIO SYLVAIN
Massachusetts Institute of Technology

FROM THE EDITORS

It has been a little more than a year since students at the Ross School of Business gathered to start an interdisciplinary business journal. Since then, the Michigan Journal of Business has been at the forefront of disseminating cutting-edge research by undergraduate students around the world. We are grateful and humbled by the positive responses we have generated. The Journal is currently being distributed to prestigious academic institutions in five continents, and is cataloged at world-renowned libraries, including the Baker Library at the Harvard Business School, the Main Library of Princeton University, and the Kresge Library at the Ross School of Business. Recently, the Journal has also been accepted into the Directories of Open Access Journals (DOAJ), a scholarly journal database that enlists more than 3000 of the world's leading publications. For our second issue, twenty-six submissions were generated from elite institutions around the world, giving us the luxury to publish only those that were deemed exceptional.

This edition contains four articles, which center on the theme of internationalism and macroeconomic factors. These issues are both timely and important. The acceleration of international economic integration and the tumultuous shift in external environments require business leaders and scholars alike to possess a deeper understanding of macroeconomic factors. Business operations, after all, have moved away from merely converting raw materials into an intricately complex process that cannot be understood in vacuum. The first article, "Has the Euro Increased Trade?" deals with the introduction of the Euro and its effect on international trade. The second article, "The Coming Chinese Century: Boon or Bane for Southeast Asia," discusses the implications of China's growth on business and economic activity in Southeast Asia and analyzes the situation from a macroeconomic standpoint. The third article, "Greater Equivalency of High School Equivalents?" presents a novel finding on the effects of the GED tests on the labor market. Lastly, "The Effects of Excise Tax on Cigarette Consumption," assesses the classic case of excise taxes and cigarette consumption with special attention to the effects on different demographic groups.

We would like to thank Professor Scott Moore, along with our faculty sponsors at the Stephen M. Ross School of Business for their continuous support and leadership. We would like to thank all of our editors as well as our finance, marketing, and web directors that played an invaluable role in helping us complete this project. Their dedication and hard work have played an integral role in allowing the Journal to keep its peer-review integrity. Furthermore, we would like to acknowledge Mr. Nathan Rupp from the Kresge Library and Ms. Erika Busch of the BBA Program Office for sharing their expertise and

assisting us with the distribution process. We would like to thank the Thomas C. Jones Center for BBA Education and the Student Government Association at the Ross School of Business for providing us with the financial means to bring this project to fruition. Last but not least, we would like to thank the authors for submitting their articles and (more importantly) for putting up with our countless revision requests.

Charley Q. Li
William J. Moon
EDITORS-IN-CHIEF

Has the Euro Increased Trade?

Danny McGowan[1]
University of Nottingham
Leverhulme Centre for Research in
Globalisation and Economic Policy

Abstract

A great deal of debate in academic, business, and political circles precipitated the introduction of the Euro. Until recently, however, a lack of data rendered quantifying the impact of the single currency upon members' trade impossible. This paper is one of the first to explore such issues. At best the Euro has been responsible for an 11 percent increase in Eurozone members' trade over the period 1999-2004. There appears to be an inverse relationship between a country's initial openness to trade and its trade activity following its participation in the European Monetary Union. There is also evidence that during the period prior to the introduction of the Euro, trade increased in anticipation of the single currency's introduction. Finally, Eurozone members appear to trade less with non-members in the wake of the European Monetary Union.

[1] Danny McGowan is a PhD Economics student at the University of Nottingham. He wrote this paper while he was a BSc Economics student at the University of Bristol. He encourages all questions and comments to be sent to **lexdm4@nottingham.ac.uk**. He would like to thank Dr. Edmund Cannon and Anna, Breige, Kathleen and Imelda McGowan. He would also like to thank Emma McGowan.

I. Introduction

The debate as to whether a country should join a currency union was once cast as a struggle between competing political ideals. The left argued for monetary union but had little supporting evidence of possible gains. The right was in staunch opposition since such a step would emasculate domestic monetary policy and expose the economy to business cycle fluctuations. Recently a new topic of enquiry has emerged in the economic debate focusing on the effect monetary union has upon trade. This is the topic I address in this paper.

Initially, monetary union was perceived to have mainly microeconomic effects through ease of price comparison and the removal of exchange rate transaction costs. Now authors, such as Rose (2000), have begun to explore the macroeconomic dimension, claiming that joining a currency union can lead to increases in trade of almost 400 percent.[2] Others, such as Persson (2001), found the effect to be approximately 13 percent.[3] The lack of data from well developed countries engaged in monetary union posed a problem for these investigations. However, with the introduction of the Euro as the official currency of 11 European Union countries in 1999 and the subsequent decision of two more countries to join the 'single currency', data is becoming available upon which to test the currency union effect on trade for large, well developed countries.

The structure of the paper is as follows. Section 2 presents a literature review of monetary union. I describe the contributions of some of the most important works in the field such as Mundell (1961)[4] and Rose (2000)[5]. Section 3 contains a gravity model built upon optimising decisions by firms that will be used to estimate whether the Euro has had an effect upon trade in the member countries. Section 4 details the data set I use, and basic summary statistics and features of the data. Section 5 deals with an estimation of the currency union effect. A model similar to that employed by Rose (2000) is used before moving on to panel data estimators, dynamic panel data models and a difference-in-difference estimator. Further sensitivity tests are performed to analyse whether the inclusion of openness to trade measures affects the results and whether there is any evidence of trade diversion arising from the implementation of the Euro. Conclusions are offered in section 6.

---

[2] Rose, Andrew. "One Money, One Market: Estimating The Effect of Common Currencies on Trade." Economic Policy 15.30 (2000): 7-45.

[3] Persson, Torsten. "Currency Union and Trade: How Large is the Treatment Effect?" Economic Policy 33 (2001): 433-448.

[4] Mundell, Robert. "A Theory of Optimal Currency Areas." American Economic Review 51 (1961): 509-517.

[5] Rose, Andrew, Ibid.

II. Literature Review

2.1 Background

It is important to stress that the introduction of the Euro constitutes the third stage of the Economic and Monetary Union (EMU) of the European Union. During the first stage (1990-93), countries agreed upon the complete abolishment of capital controls amongst European Economic Community members. Economic convergence criteria relating to inflation rates, public finances, interest rates and exchange rate stability were also negotiated. The second stage of EMU (1994-1998) witnessed the signing of the Stability and Growth Pact (SGP). This was designed to enforce fiscal discipline by prohibiting member countries from running annual budget deficits in excess of 3 percent of GDP. The European Central Bank (ECB) was also established during this epoch. It now has responsibility for setting interest rates for the Eurozone.

The convergence criteria outline rules that future Euro members must fulfil if they are to adopt the single currency, which constitutes the third stage. These include the following. A country's inflation rate must be no more than 1.5 percent higher than that of the three euro zone countries with the lowest rates of inflation. The long-term nominal interest rate must not be more than two percentage points higher than in the three lowest inflation member states. The ratio of gross government debt to GDP must not exceed 60 percent at the end of the year preceding accession. Finally, countries must have joined the Exchange Rate Mechanism (ERM II) for two consecutive years and must not have devalued their currency during this period. One should also note that while Euro members coordinate monetary policy, they also cooperate on some other economic policies. For example, tariffs are set for the EU as a whole.

2.2 The Optimal Currency Area

The origins of the optimal currency area (OCA) theory may be traced to Mundell (1961).[6] An OCA may be deemed to be a region where, in the presence of a perfectly effective monetary policy, asymmetric real shocks would be handled in such a way that full employment and zero inflation would ensue. Consequently the nation state may not represent an OCA. Rather an OCA may comprise:

1. A country
2. A region, or regions, within a country
3. Regions within separate countries

[6] Mundell, Robert. "A Theory of Optimal Currency Areas." American Economic Review 51 (1961): 509-517.

4. Multiple countries

Mundell (1961)[7] goes on to demonstrate that a country which does not constitute an OCA will react sub-optimally to a negative real shock.

The following example helps to illustrate this. Imagine that two countries are identical in every respect, that they share a border, that the east of each country produces paper and that the west produces aeroplanes. A negative shock to the demand for paper will result in higher unemployment in the eastern regions of both countries. To counter this, the central bank could relax monetary policy in order to restore full employment in the paper industry. In so doing, inflationary pressures would be created in the west. Thus there exists a trade-off between lower unemployment in one region and higher inflation in the other. This is clearly sub-optimal. If the regions of each country were to adopt their own currency, a Pareto improvement would follow as each region could optimally respond to an asymmetric shock. However, this is not the first-best solution and could be improved upon because this arrangement involves more transaction costs due to there being four currencies. If the eastern and western regions of each country were to join in monetary union, the costs of international trade would be minimised and shocks to the terms of trade could be dealt with in such a way that full employment would not come at the price of higher inflation.

From this it is eminently clear that a key consideration when deciding whether or not to join a currency union is the extent to which the business cycles of the regions overlap. The greater the degree of synchronisation, the greater will be the effectiveness of monetary policy in the enlarged region. This will be more likely when more intra-industry trade takes place as opposed to inter-industry trade. Under the former, industries in the regions are broadly similar; for example, they are predominantly engaged in the production of paper. Hence when real shocks hit the economy, monetary policy can respond in the appropriate, counter-cyclical manner. Where trade takes place on an inter-industry basis, real shocks are less likely to be off-set according to the first-best solution, as the trade-off between inflation and unemployment again exists.

The extent of integration is, thus, a key consideration when deciding upon joining a currency union. This, however, may be endogenous as sharing a currency could lead to greater levels of trade and thus greater integration. Despite this, the decision to join a currency union could then be seen as the extent to which the business cycles of different countries are synchronised. Foregoing the national currency entails a loss of monetary autonomy thus

[7] Mundell, Robert. "A Theory of Optimal Currency Areas." American Economic Review 51 (1961): 509-517.

preventing a policy-maker from dampening business cycle fluctuations. The degree of synchronisation between a group of countries will then depend upon the nature of trade between them.[8] Theoretically, pan-national business cycles could either become more or less integrated. If countries were to become more specialised in the areas in which they hold a comparative advantage, closer trading relations would lead to more idiosyncratic business cycle patterns. Consider, for example, a two country scenario where country A is relatively more efficient in producing apples while country B holds an advantage in the production of bananas. Post trade liberalisation, each country could specialise in the production of the good they produce most efficiently and then trade apples for bananas. The effect of trade then increases the degree of industrial specialisation. Business cycles would become more idiosyncratic since each country is buffeted by different real shocks.

However, several authors have found that the greater the extent of integration, the more trade will increase, leading to more highly correlated business cycles between the countries involved. Frankel and Rose cite Eichengreen (1992),[9] Kenen (1969),[10] and Krugman (1993)[11] as having all noted this feature of closer integration. Frankel and Rose use instrumental variables to estimate empirically whether trade intensity results in greater income correlation. The regression they use is of the following form:

$$\mathrm{Corr}\left(v,s\right)_{i,j,\tau} = \alpha + \beta \mathrm{Trade}\left(w\right)_{i,j,\tau} + \varepsilon_{i,j,\tau} \qquad (1)$$

The motivation for using instruments is twofold. Firstly, the error component is likely to be correlated with the trade variable in either the time or spatial dimension. For example, the Spanish-Portuguese trade observation for December may not be independent of that for November, or independent of the French-Spanish observation. Secondly, ordinary least squares (OLS) is inappropriate as countries are more likely to peg their currency to that of their main trading partners in order to eliminate exchange rate instability more effectively; that is, members join in a non-random manner. The instruments used are the natural logarithm of distance between business hubs, a dummy variable for geographic adjacency and a dummy variable that indicates a common language. Frankel

[8] Frankel, Jeffrey, and Andrew Rose. "The Endogeneity of the Optimum Currency Area Criteria." Economic Journal 108 (1998): 1009-1025.

[9] Eichengreen, Barry. "Should the Maastricht Treaty be Saved?" In Frankel, Jeffrey, and Andrew Rose. Economic Journal 108 (1998): 1009-1025.

[10] Kenen, Peter. "The Theory of Optimum Currency Areas: an Eclectic View." In Frankel, Jeffrey and Andrew Rose. Economic Journal 108 (1998): 1009-1025.

[11] Krugman, Paul. "Lessons of Massachusetts for EMU." In Frankel, Jeffrey and Andrew Rose. Economic Journal 108 (1998): 1009-1025.

and Rose found that, regardless of whether they normalised by trade or GDP, greater intensity of international trade led to higher correlations between income. This effect was strongly positive and statistically significant.

Another channel through which adjustment may occur in response to a real shock is labour mobility. If labour is sufficiently mobile, it could move from an area stuck in recession to one where job opportunities exist. This would help dampen business cycles and is often mooted as the reason why the United States constitutes an OCA while the European Union does not. The language barrier, which exists between the European nations, is not present in the United States. Despite this, labour mobility in the US is not of a sufficient magnitude to dampen business cycle fluctuations at regional level.

2.3 Reasons for Adopting/Maintaining a National Currency

The post-World War II era has seen the number of countries more than double, accompanied by an unprecedented increase in economic integration and interdependence. It is somewhat surprising, therefore, that the number of national currencies in circulation through out the world has increased dramatically since the greater the level of integration the greater the level of synchronisation. This reduces the opportunity cost of removing a currency. However, greater economic integration would imply that the costs of a national currency would be higher arising from exchange rate transaction costs. One would have to believe that the national unit is chosen to correspond with the OCA. This would seem to be incidental. It is possible that the growth in the number of countries has resulted in interregional trade being relabelled as international trade and that this process has allowed independent monetary policy to be used to stabilise the (smaller) economy. Alesina et al (2000) refute this idea.[12]

Numerous authors have suggested that pride and sovereignty are the principle motives for maintaining a national currency. However, citizens do not appear to mind when the national currency is renamed following an inflationary crisis. In fact one would have thought that national sports teams inspire greater devotion and euphoria than does a currency. Inflation aversion could be a disguise for national pride. Decimalisation and the introduction of the Euro were associated with increases in prices. This theoretically could have been caused by menu-cost effects. According to the Barro-Gordon model of monetary policy, agents may prefer decisions to be made nationally because the preferences of the policy maker are more representative of attitudes towards inflation. This could be the reason for some countries' citizens being so op-

[12] Alesina, Alberto, Robert Barro, and Silvana Tenreyro. "Optimal Currency Areas." NBER Working Paper Series Working Paper 9072 (2002).

posed to the adoption of a foreign currency as the new policy maker may have a different attitude towards the trade-off between inflation and output.

Irrespective of the number of currencies in circulation, Mundell (1961) noted that the use of multiple currencies results in a deadweight loss because of the higher transaction costs agents must bear when they engage in international trade[13]. Mundell then goes on to state that while the optimal number of currencies is not infinite, although this would mitigate a 'perfect' response to a real shock, the transactions costs arising from trade would be overwhelming. Equally the optimal number would not be one as this could be welfare decreasing due to the inability to stabilise the domestic economy.

2.4 Public Goods, Inflation and Monetary Union

Small countries may not be big enough to provide public goods efficiently as they cannot exploit economies of scale in the way that larger countries can.[14] Two areas that illustrate this idea are military defence and national currency. With both, the expense of 'going it alone' is high due to the fixed costs involved. Small countries have overcome the problem of military defence by forming alliances. The decision of the Baltic states to join NATO is an example. Regarding currency, countries that have seceded from others have been notably reluctant to adopt the currency of a large trading partner. Montenegro and East Timor are recent exceptions. This, presumably, is because the only viable currency of the newly independent country would be that of the nation from which it has just seceded. In this case, nationalist sentiment or revulsion for the former occupier may preclude monetary union.

A second, more powerful argument for monetary union than the public goods case is the conduct of monetary policy. Let us suppose that there exists a country that is particularly prone to expansionary monetary policy. An inflation bias as demonstrated by Barro and Gordon (1983)[15] may exist. This bias could be eliminated or reduced by pegging the national currency to that of a country with monetary discipline and an aversion to inflation. The monetary policy of the inflation-prone country would then effectively be determined by the disciplined central bank. This would eliminate the tendency to follow a persistently expansive, monetary policy and, consequently, the inflation bias.

---

[13] Mundell, Robert. "A Theory of Optimal Currency Areas." American Economic Review 51 (1961): 509-517.

[14] Alesina, Alberto, Enrico Spolaore, and Romain Wacziarg. "Trade, Growth, and the Size of Countries." Harvard Institute of Economic Research Working Papers Working Paper 1995 (2002).

[15] Barro, Robert, and David Gordon. "A Positive Theory of Monetary Policy in a Natural Rate Model." Journal of Political Economy 91 (1983): 589-610.

One could argue that short run considerations, such as recessions, provide support for maintaining monetary autonomy. Policy makers could then (theoretically) end a recession. A classic example of this was the UK's exit from ERM in 1992 (although one could argue currency speculation was a major factor). It could be further argued that a country with a preference towards expansionary monetary policy would never want to forego monetary autonomy as it could always raise welfare by increasing output beyond its natural rate. While this is feasible in the short run, such a policy is unsustainable over a longer horizon. Agents would rationally expect consistent monetary expansion and respond by raising their inflation expectations. Prices would persistently increase with no offsetting gains in output. The gains to eliminating the inflation bias would then be large.

One means of eliminating an inflation bias might be through the use of fixed exchange rates. These, however, tend to create imbalances in financial markets. The currency crises of the 1990s demonstrated that developed countries were just as susceptible to attack as developing nations. Numerous authors have noted that, when the costs of maintaining the fixed exchange rate were too high or where the domestic economy could benefit through the use of domestic monetary policy, a speculative attack would force an end to a peg. Hence fixed exchange rates lack full credibility. Over the past 40 years, they have not been fixed irrevocably,[16] and many have been eliminated, which may provide the stimulus for a speculative attack.

A currency union represents a more durable commitment that delivers the same outcome. The costs of abandoning the new currency are very high. In this situation, the domestic inflation rate is as in 2.

$$\pi_i = \pi_j + \Delta\rho \qquad (2)$$

Inflation in country *i* is composed of the inflation rate in the anchor country, *j*, plus or minus the change in relative price level between the domestic and anchor economy.[17] As noted previously, the higher the correlation between business cycle shocks, the greater the capacity for monetary policy to be used in a counter-cyclical manner to achieve stabilisation.

2.5 Trade Benefits

The public goods and inflation arguments for joining a currency

[16] Alesina, Alberto, Robert Barro, and Silvana Tenreyro. "Optimal Currency Areas." NBER Working Paper Series Working Paper 9072 (2002).

[17] Alesina, Alberto, Ibid.

union are attractive. However, the empirical literature that began to emerge during the mid-1990s suggests that perhaps the most important consequence of common currency areas was the increase in trade.

One of the first publications in this area was McCallum (1995).[18] This paper examined whether the US-Canadian border had had a substantial effect upon trade between states and provinces using 1988 import and export data on the 10 Canadian provinces and the 30 US states that accounted for more than 90 percent of Canada-US trade. To estimate this, a simple gravity model was used,

$$x_{ij} = a + by_i + cy_j + dDIST_{ij} + eDUMMY_{ij} + u_{ij} \qquad (3)$$

where x_{ij} is the logarithm of trade between region i to region j, y_i and y_j are the logarithms of GDP in region i and j respectively, $DIST_{ij}$ is the logarithm of the distance between i and j, $DUMMY_{ij}$ is a dummy variable equal to 1 for state-to-province trade and equal to zero otherwise, and u_{ij} is an error term.

McCallum's headline-grabbing finding was that province-to-province and state-to-state trade was 22 times greater than province-to-state trade. This was even more remarkable as, at that time, the US-Canadian border was seen as being one of the most open in the world since a free trade agreement had been signed in 1988. In addition, both countries used the same language and had solid laws governing the enforcement of contracts. One of the reasons advanced as a possible explanation for such a large difference in trade volumes was the use of different currencies.

However, the findings of McCallum were not as robust as first thought due to omitted variable bias and the failure to take into account the small size of the Canadian economy. The simple specification of equation 2 fails to acknowledge multilateral resistances as well as bilateral resistances. The bilateral barriers to trade between countries are manifested through tariffs, non-tariff barriers and the currencies used, to list just a few of the impediments to trade. Anderson (1979) defines multilateral resistance as the resistances to trade arising between country i and all other countries except j.[19] Multilateral resistances to trade affect the trade between country i and j because the resistances to trade between i and all countries other than j will indirectly determine how much i trades with j. For example, if a given country, k, has lower trade barriers with i than the average barrier between i and j, firms in i can deal more

[18] McCallum, John. "National Borders Matter: Canada-U.S. Regional Trade Patterns." American Economic Review 85 (1995): 615-623.

[19] Anderson, James. "A Theoretical Foundation for the Gravity Equation." American Economic Review 69 (1979): 106-116.

cheaply with firms from *k* than from *j*, making them more likely to trade with *k*. In summary, after controlling for size, interregional trade is a decreasing function of the bilateral trade barrier between *i* and *j,* relative to the average barrier to trade of *i* and *j* with all other regions. Anderson and van Wincoop (2003) cite multilateral resistances as being the omitted variables which drive McCallum's results.[20]

The second factor leading to bias in the estimates was the failure to account for the small, open nature of the Canadian economy. Small economies tend to engage in trade to a much greater extent than large ones because their domestic markets tend to be constrained by their small population. Consequently, a small economy must engage in international trade if it is to buy and sell goods and services. Anecdotal evidence exists to support this. For example, Ireland and Belgium, which are both small and open economies, exhibit openness to trade ratios well in excess of 100 percent. This means that the ratio of trade to GDP is greater than 1. It was, therefore, almost inevitable that the Canadian economy would be more susceptible to barriers to trade because, unlike the United States, a much greater percentage of its trade was conducted outside the country rather than inside. A small barrier between Canada and the rest of the world has large effects on the multilateral resistances to trade as the economy is more exposed to international trade. However, the effect of the border on the US is much smaller because a large percentage of its trade is conducted between its own states. This explains why the border affects it to a lesser degree.

In an attempt to ascertain the accuracy of McCallum's findings, Anderson and Van Wincoop (2001) first derived a theoretical gravity model based on constant elasticity of substitution (CES) preferences[21] In so doing and controlling for size and distance, they incorporated multilateral resistance terms. Using 1993 data they estimated that the Canadian-US border reduced trade between the countries by 44 percent. They also found that the border reduced trade with other industrialised nations by 30 percent. The within-country increase in trade after imposing the border was also much lower; a 6- fold increase and a 25 percent increase for Canada and the US respectively.

2.6 Trade and Currency Unions

The period prior to the introduction of the Euro saw numerous publications attempting to quantify the possible effect of monetary union on trade. In a seminal paper in this area, Rose (2000) used data drawn from existing cur-

[20] Anderson, James, and Eric Van Wincoop. "Gravity with Gravitas: A Solution to the Border Puzzle." Boston College Working Papers Working Paper 485 (2000).

[21] Ibid.

rency union members.[22] It was found that currency unions raised trade between members by approximately 400 percent using an OLS estimator. Further papers by Rose established that the effect was robust and statistically significant to various model specifications.

Rose and van Wincoop (2001) espoused the view that currency unions had such an impact because of the efficiency gains associated with using one, rather than multiple, currencies.[23] This was puzzling since the cost of hedging was low due to the prevailing, extensive derivative markets. The authors then hypothesised that a shared currency could lead to a deepening of trading relations and increased price transparency across countries. This could prove to be trade enhancing. The central weakness of this finding was, however, that it was based on a very small sample of observations drawn from countries which were either small, poor or remote or, in some instances, all three. Several were also island nations and therefore, more likely to engage in trade. Hence the conclusions of this paper, while seemingly robust and highly significant, could not automatically be applied to the large, developed nations that were about to introduce the Euro as their currency. The currency unions used by Rose (2000)[24] tended to comprise nations that were geographically disparate and usually had within them one large developed country and a number of small and/or poor nations or colonies. France and Reunion is a typical example. Quah (2000) remarked that of the 33903 bilateral trade observations, a mere 320 were between currency union members.[25] This meant that the results were drawn from a sub-sample which constituted less than 1 percent of the total observations.

An ambitious attempt to resolve the 'true' effect of currency unions on trade entailed the use of a non-parametric matching technique by Persson (2001).[26] This was prompted by the small number of changes in the monetary regime of most countries. The currency union effect could, therefore, only be gauged through cross-sectional variation rather than through observation of

---

[22] Rose, Andrew. "One Money, One Market: Estimating The Effect of Common Currencies on Trade." Economic Policy 15.30 (2000): 7-45.

[23] Rose, Andrew, and Eric Van Wincoop. "National Money as a Barrier to International Trade: The Real Case for Currency Union." American Economic Review 91.2 (2001): 386-390.

[24] Rose, Andrew. "One Money, One Market: Estimating The Effect of Common Currencies on Trade." Economic Policy 15.30 (2000): 7-45.

[25] Quah, Danny. "One Money, One Market: Estimating The Effect of Common Currencies on Trade*."* In Rose, Andrew. Economic Policy 15.30 (2000): 7-45.

[26] Persson, Torsten. "Currency Union and Trade: How Large is the Treatment Effect?" Economic Policy 33 (2001): 433-448.

the difference before and after monetary union. Persson also argued that if the currency union variable was correlated with any of the other regressors, or if selection into a currency was non-random, then the linear regression framework used in Rose might have produced biased results.

Using this methodology, Persson was able to construct a treated group (members of a currency union) and a control group (non-members) which were comparable in that they had the same regressors. The results were then generated using non-parametric estimators which yielded a treatment effect ranging between a 15 and 63 percent increase in trade. The standard errors, however, were of a magnitude that rendered the results statistically insignificant.

III. The Gravity Model

In this section I outline the gravity model I will use to estimate the currency union effect of the Euro. The empirical literature has tended to remain silent regarding the theoretical foundations of such models. This may be partly explained by how well the models work empirically despite their lack of microeconomic foundations. The theoretical literature reveals a great deal of variety as to how these models were derived. For example, Anderson's (1979) model is constructed using goods distinguished by their region of origin.[27] Bergstrand (1989) derives the gravity equation from an economies of scale trade model.[28] Deardorff (1995) demonstrates that a Heckscher-Ohlin model may be used as a premise for deriving a gravity equation.[29] One unifying element among all these papers is the use of CES preferences.

3.1 The Model

Traditionally, it has been the case that empiricists have used gravity models to estimate the effect of monetary union on trade. An example of this model is:

$$\ln T_{ij} = \beta_1 \ln Y_i + \beta_2 \ln Y_j + \beta_3 DIST_{ij} + \beta_4 \ln S_i + \beta_5 \ln S_j + \beta_6 X_{ij} + \beta_7 cu_i + \varepsilon_{ij} \quad (4)$$

where T_{ij} represents trade between i and j, Y_i and Y_j stand for GDP in i and j, respectively, $DIST_{ij}$ is the distance between the regions, S_i and S_j are measures of the size of i and j, usually taken as meaning either population or land mass,

[27] Anderson, James. "A Theoretical Foundation for the Gravity Equation." American Economic Review 69 (1979): 106-116.

[28] Bergstrand, Jeffrey. "The Gravity Equation in International Trade: Some Microeconomic Foundations and Empirical Evidence." Review of Economics and Statistics 67 (1985): 474-481.

[29] Deardorff, Alan. "Determinants of Bilateral Trade: Does Gravity work in a Neoclassical World?" NBER Working Paper Series Working Paper 5377 (1983).

X_{ij} is a matrix that contains a number of other possible determinants of trade such as a free trade dummy variable, a common language dummy variable and a dummy variable indicating a shared colonial history, and so on, cuij is a dummy variable equal to one if the countries share the same currency and ε_{ij} is a well behaved error term.

3.2 Features of the Model

The main ideas behind the model are that countries with a high GDP will trade more because they have/demand a greater number of goods, while distant countries are assumed to trade less because the greater the distance, the greater the costs regarding transportation and creation of trading contacts and relationships. However, while the models work well empirically with R-squared values of approximately 0.80 reported in Bergstrand (1985)[30] for the years 1965, 1966, 1975 and 1976, the theoretical foundations underpinning them tend to be simplistic and based upon intuitive arguments rather than on microeconomic fundamentals.

Owing to the lack of a single unifying framework, omitted variable bias and model uncertainty arise. As noted previously, omitted variables in the shape of multilateral resistance terms, was one of the principle reasons why McCallum (1995) found the Canada-US border to have had such a large impact on trade between the countries.[31] Similarly, authors often include a battery of dummy variables to control for determinants of trade such as free trade, colonial heritage and language.

IV. Data and Methodology

4.1 Data Sources and Definitions

This paper uses a large panel data set, constructed from a variety of sources, resulting in 51,831 observations drawn from 12 Eurozone and 3 non-Eurozone countries' trade with 187 countries. A complete list of the trade partner countries in the data set is provided in Table 10 in Appendix 1.1. The Eurozone members in the sample are Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal and Spain, while the non-Eurozone members are Denmark, Sweden and the United Kingdom. All of these countries adopted the Euro in 1999 with the exception

[30] Bergstrand, Jeffrey. "The Gravity Equation in International Trade: Some Microeconomic Foundations and Empirical Evidence." Review of Economics and Statistics 67 (1985): 474-481.

[31] McCallum, John. "National Borders Matter: Canada-U.S. Regional Trade Patterns." American Economic Review 85 (1995): 615-623.

of Greece, which joined in 2001. Other currency unions present in the data set are between France and French Guiana through the use of the French franc and between Belgium and Luxembourg through a fixed exchange rate. For each of these currency unions, the member countries are engaged in monetary union for the entire period covered by the sample. As with several of France's overseas Departments, French Guiana adopted the Euro as its official currency at the same time as France. Similarly, Belgium and Luxembourg also adopted the Euro as their official currency in 1999.

For the period 1980-2004, the real GDP per capita data are constructed using Penn World Tables 6.2 edition. Real GDP per capita is expressed in thousands of US dollars with 2000 prices acting as the base year. For the same period, the population data is also constructed using the Penn World Tables 6.2 edition data. The distance between countries is based on the great circle distance between the two countries, with the central point in each country being its capital city.

Data on bilateral trade between countries comes from the United Nations Statistics Division's Common Database. As is usual in this literature, bilateral trade is taken to be the sum of imports and exports during a given year. One point to be noted in the dataset is that the value of exports from country *i* to country *j* is not necessarily the same as the value of imports into *j* from *i* for any given observation, that is

$$x_{ij} \neq m_{ij}$$

To overcome this measurement error problem, I take a simple mean of the trade statistics for each country. However, since there is a danger that the differences between the reported trade statistics could be large, I will also use a weighted least squares (WLS) estimator.

The common language dummy variable is assigned a value of 1 when country *i* shares the same language as *j* and 0 otherwise. This information is taken from the CIA World Factbook. A common language is assumed when one of the official languages of country *i* is the same as that used in country *j*. Consequently, a country may share a common language with more than one trading partner despite its trading partners using a different language. A good example of this is Belgium which has three official languages.

The free trade dummy is equal to one if a country is a member of the European Free Trade Association (EFTA), the European Union or the European Economic Community. Otherwise, it is equal to zero. For simplicity, I assume that a free trade agreement (FTA) is in place if two countries have signed a bilateral trade agreement. The shared colonial history dummy takes a value of 1 if the trading partners were engaged in a colonial relationship at any point in

the post-1945 period. Otherwise it assumes a value of zero.

Finally, the currency union dummy takes a value of 1 from the year that a country adopts the Euro as its national currency or the currency of another country. Otherwise the variable assumes a value of zero. Despite the introduction of the Euro in physical form in 2001, all Eurozone members, except Greece, are taken to be engaged in monetary union from 1999 since this was the year in which all national currencies were unilaterally fixed at their agreed exchange rate. This, in effect, made the Euro each member's national currency and the ECB responsible for monetary policy throughout the bloc.

4.2 Description of the Data

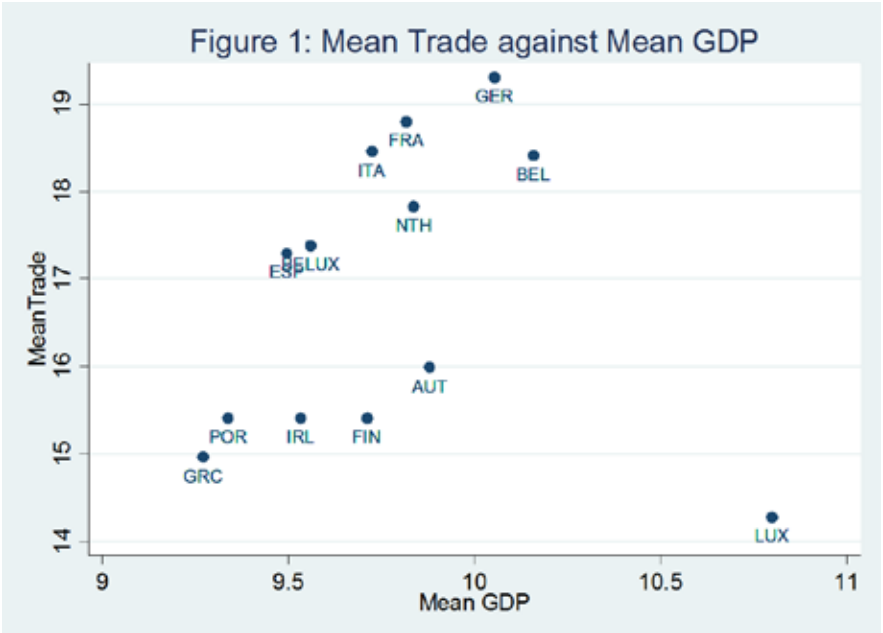
With the data collected, I have assembled a large unbalanced panel data set. The unbalanced panels are caused, in some cases, by poor records and misreporting of the actual data, which might lead to measurement error and thus biased results. Secession has also meant that many countries have entered the panel over the period while the unification of a few countries has led to some dropping out. The Soviet Union and other command-based communist countries are excluded because they bear little resemblance to the market economies with which I am concerned.

Belgian statistics are only reported for 1998 to 2004 and Luxembourgian statistics for 1999-2004. Prior to 1998, all data for the two countries are reported as though they were one country, an artefact of their economic and monetary union agreement that has been in place since 1921. A consequence was that trade statistics were produced for Belgium-Luxembourg rather than for each country. Data are available for the separate entities post-1998 as a result of a ruling by the EU which demanded that individual countries report trade and GDP on a country specific basis.

There is a danger that the inclusion of Luxembourg could bias the results of the estimation procedure. This is caused by the small size of Luxembourg in both the geographical and economic sense and also by its very high GDP and openness to trade. To establish whether Luxembourg should be omitted from the sample, I perform a series of robustness checks.

From Figure 1, it is clear that Luxembourg's very high GDP and low relative level of trade could potentially bias the results downwards or even impose a negative relationship upon any linear regression. To verify whether this is the case, I perform robustness checks to see whether the inclusion of Luxembourg seriously affects the regression estimates. This is achieved using a pooled OLS regression on the entire period.

I find that the inclusion of Luxembourg does have an influence on the



results. However, this is not to the extent that the coefficients depart hugely from the results derived when only the other 11 countries are included. Indeed none of the variables change in sign when Luxembourg is included and the largest change in the estimated results is a meagre 0.05 reduction in the GDP per capita coefficient. With this said, I turn my attention to summary statistics and correlations amongst the variables prior to embarking upon any regression analysis. The correlations between each of the variables are shown in Table 1 below.

It is clear from this that trade is strongly correlated with many of the variables since five of them have correlation values in excess of 0.20. There also appears to be a modest relationship between the currency union dummy variable and trade with a correlation of approximately 0.20. Indeed, currency unions in the sample seem to exhibit correlations with most of the variables, with the exception of language and colonial history. This is unsurprising since the sample covers the Eurozone countries which have bilateral trade agreements through their membership of the European Union and tend to be fairly rich, geographically close.

4.3 Estimation Procedure

The gravity equation from the previous section serves as the basis of the estimation procedure that will be used to quantify the effect of the Euro

upon its members' trade. However, I shall append the model with the dummy variables detailed above. This is similar to the approach implemented by Rose and van Wincoop (2001).[32] It would be unwise to assume that the sole determinants of bilateral trade flows are GDP, prices and distance given the extent to which some of the variables are correlated with trade demonstrated in Table 1. For example, free trade agreements, colonial histories, a shared language, a shared border and the same currency all affect whether countries engage in trade through the removal of tariff boundaries and the establishment of relations between individuals and firms, and so on.

Table 1: Correlations

Variable	Trade	GDP_iGDP_i	GDPiGDPj per capita	Distance	Border
Trade	1.00				
GDP_iGDP_i	.8137	1.00			
GDPiGDPj per ca	.4871	.4724	1.00		
Distance	-.4440	-.2467	-.2515	1.00	
Border	.2467	1.564	.1613	-.3866	1.00
Language	.0010	-.0924	-.0518	.0592	.0732
FTA	.3362	.2410	.3630	-.3900	.2472
Colonial History	.0636	-.0162	-.1117	.0015	-.0202
Currency Union	.2023	.1677	.2284	-.2144	.1708

	Language	FTA	Colonial History	Currency Union
Language	1.00			
FTA	-.0336	1.00		
Colonial History	.3275	-.0355	1.00	
Currency Union	.0010	.5212	-.0190	1.00

V. Empirical Analysis

I shall now consider empirical testing of the currency union effect upon trade using the gravity equation to quantify the effects of the Euro upon trade in the 1999-2004 period.

5.1 Difference-in-Difference Estimation

A simple means of estimating the effect of the Euro upon trade would be to analyse how trade responded in the cases where a country did and did not join the single currency. However, one of the main difficulties in resolving the currency union effect upon trade is that we do not know what the level of trade would have been had a specific country not engaged in monetary union. In a laboratory experiment, this could be accomplished through administering treatment to one specimen (the treated group) while holding conditions con-

[32] Rose, Andrew, and Eric Van Wincoop. "National Money as a Barrier to International Trade: The Real Case for Currency Union." American Economic Review 91.2 (2001): 386-390.

stant in all regards for an identical specimen that does not receive the treatment (the control group). This provides a natural experiment since conditions are the same in every way for both the treated and the control group. One could then gauge whether the treatment had an effect and quantify its magnitude.

Ideally, one could use a similar procedure to ascertain the currency union effect on trade. However, finding a control group for the experiment is difficult. There are inherent differences in government policy, culture and the model of capitalism between the countries which adopted the Euro as their currency and the rest of the world. Despite this, there are a number of countries that could be considered for use in a control group. One possible control group could be the non-Eurozone OECD countries. There are many similarities between these well developed, rich countries which have similar institutions to those nations using the Euro. Most OECD members also have free trade agreements in place and similar GDP (although mainly through multilateral rather than bilateral agreements). Although there are similarities, there are also reasons to believe that the OECD would not constitute a good control group. Many of these, such as Japan and Mexico, are geographically distant, not just from the EU but from one another. Secondly, OECD countries do not tend to be integrated to the same extent politically or economically as is the Eurozone.

However, the decision of Denmark, Sweden and the United Kingdom to remain outside the Euro presents a potential control group which has much in common with the Eurozone countries.[33] They are EU members and thus share in the political and economic agreements of the supranational organisation. They are geographically close and conduct a large amount of trade with Euro members (for example, the UK conducts approximately 60% of its trade with Eurozone countries). One could also argue for the inclusion of some of the Eastern European countries such as the Czech Republic and Poland, but these are excluded since they only became EU members in 2004.

The object of difference-in-difference (DD) estimation is to uncover the effects of a change in policy, in this case the effect of the Euro upon trade. DD estimates are found by applying an OLS estimator to the cross-sectional panel data in the data set for the years prior to the change and then to the post-treatment period for both the treated and control groups. First, I compute average trade for each treated and control country for the pre-1999 and 1999-2004 periods. Baier et al. (2002) recommend using aggregation of the data in the before-and after-treatment periods in order to overcome problems of serial

[33] A possible downside to including Denmark is that the Krone was pegged to the Euro over the period under inspection.

correlation which often afflict DD estimators.[34] The direction of the bias in the standard errors that serially correlated observations will have depends upon whether there is positive or negative serial correlation. Positive serial correlation will result in under-reported standard errors while the opposite will occur if negative serial correlation is present.

To obtain the DD estimator I generate three dummy variables. The first is called *post*, which is equal to one if the observation comes from the post-1999 period. The second dummy is *treatment*, which is equal to one if the observation comes from the group that engaged in monetary union. Finally, I generate an interaction term, *post*treatment*, which is the result of multiplying *post* and *treatment* together. This is the coefficient of interest because it shows the estimated effects of changing the currency to the Euro. It is then possible to estimate the following equation to obtain the treatment effect:

$$T_i = \beta_1 post_i + \beta_2 treatment_i + \beta_3 post*treatment_i + \nu_i \quad (5)$$

The DD estimate is then $\hat{\beta}_3$. The results of this regression are given in Table 2.

Table 2: Difference-in-Difference Estimates

Dependent Variable: Bilateral Trade	
post	-.006
	(.06)
treatment	-1.36
	(.06)
post*treatment	.78
	(.07)
R^2	.0194
Number of observations	51831

Robust standard errors in parentheses

The results indicate that trade decreased for the control group between the two periods by 0.006 percent but this is both economically and statistically insignificant. The coefficient on treatment shows that among the countries that adopted the Euro, trade was initially on average less than among the control group, but this increased markedly in the post-1999 period as demonstrated by the *post*treatment* coefficient. Indeed, the treatment effect of the Euro is found to be colossal, with a coefficient of 0.78. The estimate is also highly significant

[34] Baier, Scott, Jeffrey Bergstrand, and Peter Egger. "The New Regionalism: Causes and Consequences." Économie Internationale 109 (2007): 9-29.

with a t-statistic greater than 11. This would appear to suggest that the currency union effect on trade is large regardless of whether countries are small, poor and remote or large, well developed and geographically centric. However, the results in Table 2 should be treated with caution. Regardless of whatever concerns one may have about the practical uses of the R^2 in applied economics, a value of .0194 is hardly robust. Indeed, this casts doubt upon whether the estimates are correct given that, at best, they explain a mere 2 percent of the variation in the dependent variable, trade. This leads me to question whether the results are in fact a product of a statistical rather than an economic relationship.

It is important to note that the DD estimates fail to take into account the endogeneity of the treatment effect. This could lead to biased estimates since the assignment of countries into the treatment and control groups is non-random. If the results were to be unbiased, then firms and agents in the period prior to 1999 must be unaware that the treatment will occur. However, this is unlikely to be the case as the Maastricht Treaty, signed in 1993, would have signalled that countries were preparing to engage in future monetary union. Firms and individuals could then have responded by taking decisions to prepare for this eventuality.

5.2 OLS Regressions

The model to be estimated takes the following form:

$$x_{it} = \beta_0 M_i M_j + \beta_1 \left(\frac{M_i M_j}{Pop_i Pop_j} \right) + \beta_2 DIST_{ij} + \beta_3 Border_{ij} + \beta_4 Lang_{ij} + \beta_5 FTA_{ij} + \beta_6 Colony_{ij} + \phi cu_{ij} + \varepsilon_{ij} \quad (6)$$

where M_i and M_j are log GDP for country i and j, respectively, Pop_i and Pop_j are log population for i and j, respectively, $DIST_{ij}$ is the log distance between i and j, Border_{ij} is a dummy variable equal to one if i and j share a common border, FTA_{ij} represents whether the trading partners have a bilateral free trade agreement, $Colony_{ij}$ indicates whether i and j have a shared colonial history post-1945, and cu_{ij} is a dummy variable equal to one if the countries use the Euro as their official currency.

Rose (2000) used pooled data from the years 1970, 1975, 1980, 1985 and 1990.[35] He then used an OLS estimator with robust standard errors to determine the effects of monetary union upon trade. It is important to note that this did not incorporate clustering effects. I begin the analysis by adopting

[35] Rose, Andrew. "One Money, One Market: Estimating The Effect of Common Currencies on Trade." Economic Policy 15.30 (2000): 7-45.

an approach similar to that of Rose, although I pool the data across the entire sample I have available. Since the estimation procedure relies upon a pooled OLS model, I use a Breusch-Pagan test to ascertain whether the disturbance terms are spherical. This produced an LM value of 2985.88, which is greater than the critical value of 2.73 at the 5 percent level of significance, leading to a rejection of the null of homoskedasticity. I then implement heteroskedasticity-robust standard errors.

The results of the regressions for the 1980-2004, 1980-1998 and 1999-2004 periods are reported in Table 3. I also include the Rose results for comparison. For the entire sample period, with the exception of the currency union dummy, all the variables appear correctly signed and are statistically significant. Some of the t-statistics are huge with values in excess of 20. However, this is not unreasonable and the magnitudes are similar to those reported elsewhere in the literature.

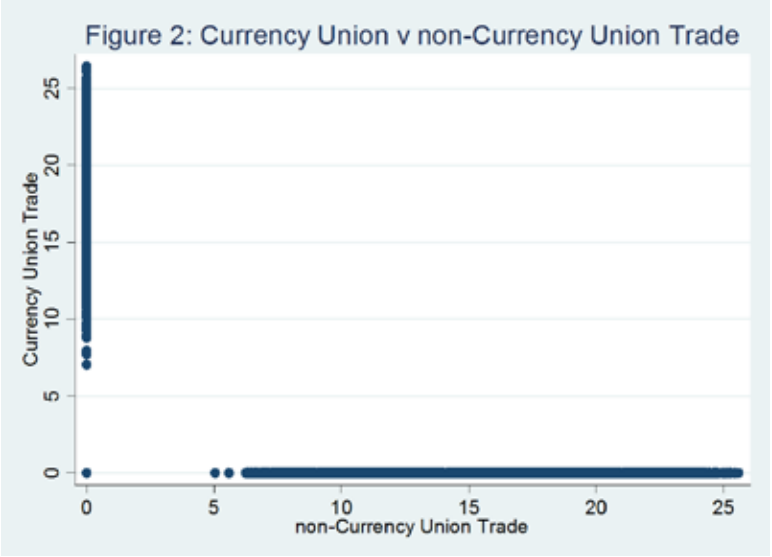
Table 3: OLS Regressions

Dependent Variable: Bilateral Trade

	1980-2004	1980-1998	1999-2004	Rose 1970-1990
GDP_iGDP_j	.93	.91	.96	.80
	(.004)	(.004)	(.01)	(.01)
GDPiGDPj per capita	.17	.26	.30	.66
	(.01)	(.01)	(.02)	(.01)
Distance	-.89	-.92	-.77	-1.09
	(.02)	(.03)	(.03)	(.02)
Border	.52	.39	.45	
	(.05)	(.06)	(.08)	
Language	.91	.92	.81	.40
	(.03)	(.04)	(.06)	(.04)
FTA	.79	.63	.68	.99
	(.03)	(.03)	(.06)	(.08)
Colonial History	1.50	1.57	1.54	2.40
	(.06)	(.07)	(.13)	(.07)
Currency Union	-.38	-2.68	.11	1.21
	(.04)	(.10)	(.04)	(.14)
R^2	.7432	.7402	.7857	.63
Number of observations	38498	27860	10638	22948

Robust standard errors reported in parentheses

The currency union effect is actually found to reduce trade between members of a common currency by approximately 38 percent over the entire period. However, this is more an artefact of the estimation procedure used and outliers. To see this, consider Figure 2 below.



This demonstrates that, when OLS is applied to the model, countries which are members of currency unions are drawn from a different panel than non-members. Consequently when the regression is run, the OLS estimator establishes a negative relationship, as this is the nature of the distribution.

Over the 1980-1998 period the currency union coefficient is far greater than that for the whole sample period and assumes a fairly implausible yet statistically significant value. However, inference is based upon a mere 16 observations which include only France and a dependency, French Guiana. Thus the estimates for this period are of little significance. The estimates for the 1999-2004 period, when the single currency came into effect, are of greater interest. It appears that GDP per capita is a better determinant of trade during this period, whereas the effect of distance between trading partners, while still significant at the 5 percent level, has decreased. A similar trend has occurred regarding language, which might signal a greater degree of interdependence across countries. However, the central finding of this regression is that the introduction of the Euro has served to increase trade among the 11 members by approximately 11 percent and the accompanying t-statistic is 2.20.

An increase in trade of 11 percent pales in comparison to the 397 per cent gains in trade found by Rose. However, the sample I use may be a better barometer in that it has within it countries which are not small, remote or poor. Only one island economy is included. The value I have found could be ‘low’ because the level of trade which had previously taken place amongst Eurozone members was high. In effect, there may be diminishing returns to trade follow-

ing the introduction of a common currency. The greater the volume of trade already conducted between members could result in the common currency having a lesser impact because of the established trading links and the free trade agreements covering all European Union members.

The results I have obtained for the period differ quite starkly from those of Rose. This is hardly surprising given the different data sets that cover different years. Ignoring this, even for the period in which the Euro is adopted, its estimated effect on trade is small in comparison to the Rose findings (0.11 against 1.21). This may be because the countries in Rose's data set have engaged in monetary union for much longer periods of time. This means the effect of using a different currency has had sufficient time to permit the establishment of trading relationships. However, it could also be the differences in the results are caused by the different countries used in mine and Rose's datasets. Perhaps the trade benefits for large countries are small.

Table 4: WLS Regressions

Dependent Variable: Bilateral Trade

	1980-2004	1980-1998	1999-2004
GDP_iGDP_i	.86	.86	.91
	(.006)	(.006)	(.005)
GDPiGDPj per capita	.23	.26	.40
	(.01)	(.01)	(.01)
Distance	-.85	-.88	-.73
	(.02)	(.03)	(.04)
Border	.56	.48	.48
	(.01)	(.02)	(.02)
Language	.73	.78	.59
	(.01)	(.01)	(.02)
FTA	.69	.69	.53
	(.01)	(.01)	(.02)
Colonial History	1.49	1.53	1.54
	(.02)	(.02)	(.03)
Currency Union	-.31	-2.49	.16
	(.02)	(.09)	(.02)
R^2	.7569	.7544	.7857
Number of observations	38498	27860	10638

Robust standard errors reported in parentheses

In Table 4 are the results from a weighted least squares (WLS) estimator. As mentioned in the previous section, this method was used to control for measurement error in the reported trade values. This estimator was computed by weighting the importance of the observation by the average trade value conducted by all countries and that specific trade partner for each year. The results do not show a large departure from those computed using OLS on the

averaged level of trade. This is mainly because there are only 131 observations that are averaged (the trade between fellow Euro members), which are unlikely to make much of an impact in a sample of more than 10000 observations. It is important to note, however, that the currency union effect is found to be larger under WLS with a coefficient of .16 and this is estimated with greater precision than under OLS, shown by the smaller standard error. The other variable coefficients show little deviation from the OLS estimates.

5.3 Tests for Serial Correlation

An important question this paper seeks to address concerns the timing of the effects of the introduction of monetary union. For example, is it the case that the increases in trade occurred immediately following the introduction of the new legal tender, or, were the effects felt before this?

The OLS estimate of an increase in trade by 11 percent for the Eurozone could be an underestimate of the eventual effects of the single currency. Trading relationships may take time to develop as exporters and importers establish contact with foreign firms which can supply the goods or services demanded. Evidently it will require time for the data to become available. However, it is also possible that the estimated effects of the Euro could be an overestimate since its effects began to surface in the period prior to its official use. If firms and individuals expect change, they may decide to take advantage of the opportunities on offer and start establishing trading relationships prior to the introduction of the new monetary regime. In this case, one would expect the error terms across countries to be serially correlated because trade between country *i* and country *j* in 1995 will be dependent upon trade at a future date.

It is also important to establish whether the errors are serially correlated as this could affect the OLS results previously found. Although the estimates would remain unbiased, the standard errors would be underreported, meaning the t-statistics are larger than they otherwise should be. If this is the case, then it is possible that we could reject the OLS estimates of the statistically significant increase in trade found in section 5.1.

To determine whether the errors are serially correlated, and if so, to what extent, an OLS regression on an autoregressive model with six lags is used. The number of l ags chosen corresponds to the number of years between the introduction of the single currency and the Maastricht treaty of 1993. In that year, members of the European Union, apart from Denmark and the United Kingdom, pledged to join the Euro. It may have been the case that firms took this as a signal, anticipated the introduction of a common currency and began to tailor their businesses so that they could respond in due course.

The model to be estimated is

$$\hat{u}_t = \rho_1 \hat{u}_{t-1} + \rho_2 \hat{u}_{t-2} + \rho_3 \hat{u}_{t-3} + \rho_4 \hat{u}_{t-4} + \rho_5 \hat{u}_{t-5} + \hat{u}_{t-6} + \xi_t \quad (7)$$

where $\hat{u}_{t-i}$ are the residuals of an OLS regression and ξ_t is a random error.

I then use an OLS regression with clustering to control for country specific factors on (4) to test the null that $\rho_i = 0$. If ρ_i is found to be significantly different from zero, then there is evidence that the error terms are serially correlated.

Table 5: Test for Serial Correlation

Dependent Variable: OLS residuals

	Entire Sample	**Euro Members**
uhat$_{t-1}$	.175	.149
	(.0067)	(.0230)
uhat$_{t-2}$	.168	.123
	(.0066)	(.0222)
uhat$_{t-3}$	.148	.133
	(.0065)	(.0234)
uhat$_{t-4}$	.155	.101
	(.0066)	(.0224)
uhat$_{t-5}$	.147	.126
	(.0065)	(.0225)
uhat$_{t-6}$	.149	.115
	(.0065)	(.0227)
R^2	.6820	.2494
Number of observations	29216	2087

Robust standard errors reported in parentheses

The evidence in Table 5 clearly illustrates that there is serial correlation between observations over time for the entire sample and the Euro sample because the effects are found to be statistically significant for the lagged variables. In both samples, the magnitude of the effect diminishes over time. However, as shown in the second column, when the members of EMU deal with other members, the effect starts at a lower level and decreases at a faster rate than when they deal with non-members.

This may offer (very) tentative evidence that the Eurozone countries experienced an increase in trade prior to the actual introduction of the common currency. However, the low explanatory power of the regression leads me to doubt this finding. Coupled with this is the apparent inevitability that trade will

show signs of serial correlation. This makes it difficult to disentangle the effect of any response to the Maastricht treaty.

5.4 Panel Data Estimators

There is, evidently, a degree of uncertainty regarding the results extrapolated from the pooled OLS. A major concern is that there may be omitted variables, which could be acting as an influence. With OLS, estimates are only unbiased if the omitted variables are uncorrelated with the dependent variable. Furthermore, OLS plots the regression line by best fit. However, if the intercept for a certain country is higher, the greater will be the matrix of explanatory variables and OLS will overestimate the effect of a particular variable. The way in which my sample has been constructed illustrates a variation both within countries and across countries that OLS fails to exploit. One way of overcoming these problems would be the use of a fixed effects estimator. I would thereby hope to control for such omitted variables as the multilateral resistance terms mentioned by Anderson and van Wincoop (2003)[36], which could bias the results upwards. It would also mean that country specific factors, such as openness to trade and business cycles, are controlled for, as these will be contained within the fixed effect parameter.

The fixed effects estimator includes an intercept term that captures the influence of variables not included in the regression. A simple model would be of the form

$$y_{it} = \alpha_i + \beta X_{it} + \varepsilon_{it} \tag{8}$$

where α_i is the constant term, X_{it} is a matrix containing the explanatory variables and ε_{it} is an independently and identically distributed disturbance term. A fixed effects estimator assigns a dummy variable to control for each country in the sample, effectively eradicating the intercept term. However, in doing so, degrees of freedom are lost and the estimator becomes less efficient. This problem may be overcome by introducing 'centred' variables equal to the variable's value minus its mean. While this solves one problem, it introduces another, as all time invariant variables will be removed from the sample, thereby prohibiting estimation of that variable

For these reasons, I also employ a random effects estimator which seeks to lessen these problems. With the random effects model, different countries are again allowed to have different intercepts, but these are treated as being randomly assigned and as if they are an integral part of the error term.

[36] Anderson, James, and Eric Van Wincoop. "Gravity with Gravitas: A Solution to the Border Puzzle." Boston College Working Papers Working Paper 485 (2000).

Thus the model differs from the fixed effects estimator in that the error term contains two components.

$$y_{it} = \beta X_{it} + u \tag{9}$$

where

$$u_{it} = \eta_i + \varepsilon_{it} \tag{10}$$

where η_i is a random intercept term which measures the magnitude to which the individual and overall intercept differ, and ε_{it} is a random error component.

Since the random effects estimator does not impose a host of dummy variables, it produces more efficient estimates than would a fixed effects estimator. It does not eliminate all the time-invariant variables because it exploits the variation in these variables across countries, individuals, and so on, so as to gain estimates. Although the random effects estimator appears to be a silver bullet, it does have one major limitation in that it imposes the fairly strict assumption that all observations of country *i* are assumed to be independent of all other countries.

Having outlined some of the theoretical considerations behind the fixed and random effects estimators, I now use them to draw inferences. This produces the following estimates.

Table 6: Fixed and Random Effects Results

Dependent Variable: Bilateral Trade

	Fixed	Random
GDP_iGDP_j	.936	.937
	(.01)	(.01)
GDPiGDPj per capita	.358	.359
	(.01)	(.01)
Distance	-.778	-.777
	(.02)	(.02)
Border	.416	.416
	(.11)	(.11)
Language	.782	.779
	(.08)	(.08)
FTA	.709	.706
	(.08)	(.08)
Colonial History	1.492	1.496
	(.12)	(.12)
Currency Union	.067	.068
	(.09)	(.09)

The results are reported to three decimal places due to the similarities between the estimated values under the two estimators. Compared with the results reported in Table 3 for the OLS estimator, the fixed and random effects estimators show a strong similarity to one another across the variables, especially for GDP, GDP per capita, distance and a shared border. However, the panel data estimators deem language to have a greater effect, 0.78 as opposed to 0.68 under OLS. The importance of free trade agreements is also estimated to be greater at approximately 0.71 versus 0.58 under OLS, while colonial history is found to be of lesser importance under these models than when using OLS. Furthermore, under OLS, the standard error for most of the variables was smaller than when either of the panel data models was used.

While these effects are interesting, the main variable of interest, the currency union dummy, is now found to have a lesser effect upon trade than was the case under OLS estimation. Using fixed effects the Euro is estimated to increase trade by roughly 6.7 percent over the period and the random effects estimator produces a practically identical result of a 6.8 percent increase. OLS produced a statistically significant result, which was not the case with either the fixed or random effects models. Indeed these models calculate the t-statistic as a meagre 0.7, which implies that the Euro's effect upon trade by its members is either absent or has yet to materialise.

Normally a Hausman test would determine which of the two panel data estimators should be used. The reason for this is that, although fixed effects estimators lack degrees of freedom, they do allow for correlation across countries. This is fairly realistic when applied to the data set used since the level of trade conducted by France is likely to be influenced by German trade and vice-versa. Since random effects do not allow for any correlation across countries, it may be inconsistent because of the correlation between the random effect and the explanatory variables.

A Hausman specification test may be used to establish whether the random effects are orthogonal to the regressors. Under the null hypothesis, the results from fixed and random effects estimation should not differ systematically. If the test statistic is found to be less than the critical value (determined by using a chi-squared distribution for the given number of degrees of freedom), then the null hypothesis cannot be rejected. The results of the Hausman test are reported in Table 7.

Table 7: Hausman Test

	Coefficients			
	(b) **RANDOM**	(B) **FIXED**	(b-B) **DIFFERENCE**	sqrt[diag(V_b-V_B) **S.E**
GDP_iGDP_i	.9368932	.936309	.0005842	.
GDPiGDPj per capita	.3587283	.3581049	.0006234	.0003443
Distance	-.77485	-.7776264	.0001415	.0008168
Border	.4164721	.4159672	.0005049	.0041989
Language	.7788576	.7818759	-.00030182	.
FTA	.7059148	.7093338	-.0034189	.0031513
Colonial History	1.495523	1.492303	.0032205	.
Currency Union	.0680498	.0669627	.0010871	.0037628

The test statistic is calculated using the following formula and a chi-squared distribution with the degrees of freedom equal to the number of explanatory variables.

$$t = (b - B)'[V\_b - V\_B]^{-1}(b - B) \tag{11}$$

This method yields a test statistic equal to 3.66, while the critical value for eight degrees of freedom at the 5 percent confidence level using the chi-squared distribution is 15.15. Since the test statistic lies below the critical value, I reject the null hypothesis that the differences in the coefficients are systematic; that is, omitted variable bias is small. Consequently, it can be concluded that the individual effects are not correlated with the explanatory variables. This implies that the random effects model may be superior to the fixed effects model.

5.5 Dynamic Panel Data Models

The fixed and random effects estimators used in the previous section represent static panel data estimators. It is conceivable that these estimators may not encompass all the available information as the explanatory variables are assumed to produce the observed outcome in the dependent variable.[37] The introduction of lagged variables means that historical information on the dependent and explanatory variables is included in the regression. This implies that the effect of these variables is now dependent on past information. Therefore, any change in the underlying variables will constitute new information, which makes the estimation process closer to a randomised experiment. It should only pick up the effect of the introduction of the Euro.

However, this method is not without its problems. Simply appending

[37] Greene, William. Econometric Analysis: 5th Edition. New Jersey: Pearson, 2003.

a random effects estimator to incorporate a lagged dependent variable would produce correlation between the lagged dependent variable and the part of the disturbance term, $u_{i.}$. This appears in the regression for every observation in group i.[38]

$$y_{it} = \beta_0 y_{i,t-1} + x_{it}' \beta_1 + u_i + \varepsilon_{it} \quad (12)$$

One means of overcoming this problem was proposed by Arellano and Bond (1991)[39], who use a Generalised Method of Moments (GMM) estimator. The Arellano and Bond estimator takes the first difference of all the right-hand-side variables so as to remove the unobserved heterogeneity, resulting in a model of the form:

$$y_{it} - y_{i,t-1} = \beta_0 (y_{i,t-1} - y_{i,t-2}) + (x_{it}' - x_{i,t-1}') \beta_1 + (\varepsilon_{it} - \varepsilon_{i,t-1}) \quad (13)$$

Taking first differences gets rid of the fixed effect term but it does not solve the problem of correlation between the lagged dependent variable and the disturbance terms. However, the lagged differences or the lagged levels of the dependent variable may be used as instrumental variables to overcome this problem. As usual, the instruments, z_i, are assumed to satisfy the moment conditions so they are uncorrelated with the error term. A unique feature of this model is the number of instruments need not be the same over time and can increase as the time series lengthens. A minimum of three periods is required for the model to be workable.

The basic tenet of the Arellano and Bond estimator is to exploit the lack of correlation between a shock at time t and the past and future values of the dependent and explanatory variables. Despite this, adding more and more orthogonality conditions (through the use of an increasing number of instruments) will cause the estimator to tend towards OLS, which is unsurprising as an OLS estimator imposes zero correlation between the explanatory variables.

Having outlined the theoretical considerations behind the Arellano and Bond estimator, I now apply it to the data to estimate the effect of the introduction of the Euro. The results of this exercise are listed in Table 8. Delta is used to indicate where the variable is differenced.

---

[38] Greene, William. Econometric Analysis: 5th Edition. New Jersey: Pearson, 2003.

[39] Arellano, Manuel, and Stephen Bond. "Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations." Review of Economic Studies 58 (1991): 277-297.

Table 8: Arellano and Bond Estimator 1999-2004

Dependent Variable: Bilateral Trade	
delta GDP_iGDP_i	-1.48
	(.40)
delta GDPiGDPj per capita	1.90
	(.39)
Distance	dropped
Border	dropped
Language	dropped
FTA	.12
	(.10)
Colonial History	dropped
Currency Union	-.22
	-0.14
Number of observations	9060
Number of groups	1788

The Arellano and Bond estimator finds that past levels of trade exert a positive and significant effect upon the present level. This may be unsurprising since trading relationships are likely to develop over time and persist. Countries may also be dependent upon the import of certain products, such as oil, which are unavailable elsewhere. GDP is found to have a negative effect upon trade and the size of the standard error causes this to be statistically significant. GDP per capita, however, has a significant impact upon trade with a positive coefficient of 1.90, which is significant at the 5 percent level of confidence. Free trade agreements also affect trade positively, but the variable is statistically insignificant. Unlike OLS and the fixed and random effects estimators, the Arellano and Bond estimator finds that the currency union dummy lowers trade by Eurozone countries by 22 percent. However, the associated z-statistic is -1.56, which means that we cannot accept this finding at the 5 percent level of confidence.

An inspection of the results highlights the lack of estimates for coefficients on the distance, shared border and shared language variables. These

variables are dropped due to the first differencing method used by the estimator. The distance between countries and their neighbours remains constant over long periods of time. The same applies to the colonial history and language dummies. Either a country does or does not have a shared colonial history with another, likewise with language. There is no tendency for countries to eradicate one of their official languages at any point over the sample period. Thus, when the first difference of these variables is taken, the result is zero and they are dropped from the model.

5.6 Openness

The results in section 5.1 suggest that there could be a relationship between the effect of monetary union and openness to trade. It may be the case that countries which are more open to trade reap larger gains from the reduction in barriers to trade because they engage in a high level of trade.

In an attempt to overcome this problem, I investigate the currency union response among countries with an openness value below the lower quartile value, above the upper quartile threshold and above and below the mean and median openness for the 1999-2004 period.

Table 9: Openness and the Currency Union Effect

Dependent Variable: Bilateral Trade

	Lower Quartile	Upper Quartile	< Median	> Median	< Mean	> Mean
GDP_iGDP_i	.85	.93	.97	.96	.98	.98
	(.04)	(.01)	(.01)	(.01)	(.01)	(.01)
GDPiGDPj per capita	.30	.27	.37	.35	.37	.32
	(.09)	(.03)]	(.03)	(.02)	(.02)	(.03)
Distance	-1.04	-.70	-.83	-.73	-.79	-.74
	(.09)	(.04)	(.08)	(.03)	(.06)	(.03)
Border	1.10	.44	.53	.42	.36	.47
	(.27)	(.14)	(.17)	(.08)	(.12)	(.10)
Language	1.79	-.05	1.30	.34	1.13	.24
	(.24)	(.11)	(.09)	(.08)	(.08)	(.10)
FTA	.67	.78	.57	.64	.52	.75
	(.20)	(.10)	(.09)	(.08)	(.08)	(.08)
Colonial History	-.88	1.58	1.46	1.52	1.42	1.78
	(.25)	(.38)	(.16)	(.18)	(.12)	(.41)
Currency Union	.10	.06	.16	.07	.16	-.02
	(.19)	(.11)	(.07)	(.07)	(.06)	(.09)
R^2	.6342	.7050	.7797	.7876	.8156	.7492
Number of observations	656		3836	5992	5470	4358

Robust standard errors reported in parentheses

I have also tested to see whether the results differ when the sample is split into three as well five. I do not observe a large departure from the results reported in Table 9.

One interesting result of this exercise is that the currency union effect is greater for countries with an openness to trade less than the median and mean values than is the case for those with an openness to trade above these

thresholds. The effect for these groups is also statistically significant, which is not the case for the above mean and median openness samples. The currency union effect shows up as positive for countries with openness to trade that lay in the lower and upper quartiles. The absolute effect is larger for those among the bottom 25 percent than among the top 25 percent of the distribution. However, both of these variables are estimated to be statistically insignificant.

Despite the insignificance of some of the findings, there appears to be a trend towards countries with lower openness experiencing larger returns because of the introduction of the single currency. Why might this be the case? One possible explanation could be a case of diminishing returns. Those countries with high openness to trade values already conduct a large amount of international trade. The resultant elimination of exchange rate costs represents a smaller fraction of the total amount of trade conducted than for less open economies. Thus the barrier to trade that more open economies face is smaller than for less open economies.

5.7 Is there Evidence of Trade Diversion?

The introduction of monetary union reduces the transaction costs for firms dealing with other firms within the union. The removal of exchange transaction costs means that firms can deal more cost effectively with other firms using the same currency. This, and the ease with which price comparison can be conducted, could lead to firms increasing trade with other currency union members and decreasing trade with firms using a different currency.

One of the claims of Rose and van Wincoop (2001)[40] was that this trade diversion did not appear to occur in the currency unions analysed. Perhaps this was because their inferences were drawn from small, remote member countries which specialised in the production of a small range of goods. Such countries would be very dependant upon the import of essential goods and materials produced only by countries external to the currency union. This issue is less likely to feature within the Eurozone given the high volume of intra-industry trade amongst members.

The mechanisms behind trade diversion are difficult to understand. It is difficult to see why a German firm would reduce trade with a Brazilian firm if it used the Euro rather than the Deutschmark. Indeed, in both cases, the German firm would incur transaction costs to buy the required Real to deal with the Brazilian firm. Perhaps it is the case that, prior to the enactment of monetary union, only wares currently produced in another Eurozone country

[40] Rose, A. & van Wincoop, E. National Money as a Barrier to International Trade: The Real Case for Currency Union. American Economic Review: 91(2), 386-390, 2001.

were uncompetitive at the margin with Brazilian goods. However they are competitive ex-post. This could lead to a switch in demand by the German firm and thus trade diversion.

To ascertain if there is evidence of this, I generate a "rest-of-the-world" dummy variable for countries that are not a members of EMU. I then split the sample at the year 1999 and run the regression below for the first and second periods

$$x_{it} = \beta_0 M_i M_j + \beta_1 \left(\frac{M_i M_j}{Pop_i Pop_j} \right) + \beta_2 DIST_{ij} + \beta_3 Border_{ij} + \beta_4 Lang_{ij} + \beta_5 FTA_{ij} + \beta_6 Colony_{ij} + \beta_7 ROWdummy + \phi cu_{ij} + \varepsilon_{ij} \quad (14)$$

This produces the results in Table 10.

Table 10: Trade Diversion

Dependent Variable: Bilateral Trade

	pre-1999	post-1999
GDP_iGDP_i	.91	.95
	(.005)	(.01)
GDPiGDPj per capita	.26	.39
	(.01)	(.02)
Distance	-.92	-.77
	(.03)	(.03)
Border	.40	.42
	(.06)	(.08)
Language	.89	.68
	(.04)	(.06)
FTA	.69	.50
	(.05)	(.06)
Colonial History	1.59	1.59
	(.07)	(.13)
ROW Dummy	.09	-.26
	(.05)	(.05)
R^2	.7399	.7801
Number of observations	27860	9828

Robust standard errors reported in parentheses

From the results in the table above, there appears to be a tendency for the 11 EMU members to reduce trade with rest-of-the-world countries post-monetary union. In the 1980-1999 period, the ROW dummy variable is positive but statistically insignificant. In the second period, being a rest-of-the-world country is associated with approximately a 30 percent reduction in the volume of trade conducted with Eurozone members. This coefficient is also statistically significant. This may indicate that there has been trade diversion

away from non-EMU members.

However, the effect estimated for trade with a rest-of-the-world country could be biased downwards due to the omission from the data set of a multilateral free trade variable. Since the EU countries make free trade agreements with non-EU members through the World Trade Organisation and with the non-member governments, the omission of this variable could mean that the reported coefficient is found to be statistically significant when in fact this may not be the case.

VI. Conclusions

In this paper, I sought to establish whether the introduction of the Euro has had an impact upon trade. The results of this exercise are at best mixed and sensitive to the estimation procedure used. A pooled OLS, like the Rose (2000)[41] model, shows that the Euro raised trade by a statistically significant value of 11 percent. However, this fails to account for country specific effects and omitted variables.

Applying fixed effects to the data set yielded a smaller currency union value of approximately 7 percent. However, the corresponding standard error renders this statistically insignificant. Using an Arellano and Bond estimator yielded yet another estimate: a decrease in trade by 22 percent occurs because of the introduction of the single currency. As with the fixed effects estimator this too is found to be statistically insignificant. Additionally, I used a difference-in-difference estimator. This found that the Euro had increased trade by a statistically significant 78 percent. However, this estimator appears to suffer from very low explanatory power with an R^2 value of 2 percent. The results were, therefore, dubious.

Thus it may be concluded that the effects of the Euro upon trade are either fairly small, in the region of 6-11 percent, or that they will take time to manifest. Even if the trade effects were within this range, it would still constitute a large, absolute increase in the average amount of trade conducted by each Eurozone member. It may take several years before sufficient data is available on which to form a judgement.

One can also draw several normative implications relating to policy makers and businesses. Firstly, policy makers in countries considering joining the Euro should be aware that the total trade effect might not occur immediately. However, the results suggest that on average, countries that join the Euro, despite fundamental differences in the structure of their economies, experience increases in trade. This is especially important in light of the accession

[41] Rose, Andrew. "One Money, One Market: Estimating The Effect of Common Currencies on Trade." Economic Policy 15.30 (2000): 7-45.

of many eastern-European countries that have joined the EU in recent years. While these countries may gain through greater trade, the loss of monetary autonomy could impose a short-term burden upon their economies. Striking a balance between interest rates favourable for all members could also be difficult. The rapid development of many eastern-European economies, coupled with low interest rates to suit the large economies of central Europe (France, Germany and Italy), could result in high rates of inflation in the former countries. Furthermore, current Euro members must also consider the potential consequences of admitting many more countries. For example, tighter rules on the SGP may be necessary since the incentive to break the SGP increases with a greater number of members.

Lastly, businesses must also be aware that EMU membership could have implications for them. If indeed business cycles do become more synchronised across countries, then firms operating in highly specialised industries could be more susceptible to industry exit. This may necessitate the introduction of organisational strategies such as offshoring and outsourcing to cope with such pressures.

Appendix

Table 11: Currency Unions in the Data set

Euro Memebers

Country	First Observation*
Austria	1999
Belgium	1999
Finland	1999
France	1999
Germany	1999
Greece	2001
Ireland	1999
Italy	1999
Luxembourg	1999
Netherlands	1999
Portugal	1999
Spain	1999

Other Currency Union Members

France	1980
French Guiana	1980
Belgium	1980
Luxembourg	1980

* First Observation refers to the first observation in the sample period

Table 12: Difference-in-Difference Control Sample

Denmark
Sweden
United Kingdom

Table 13: Countries in the data set

Afghanistan	Djibouti	Lebanon
Albania	Dominica	Lesotho
Algeria	Dominican Republic	Liberia
Angola	Ecuador	Libya
Antigua	Egypt	Lithuania
Argentina	El Salvador	Luxembourg
Armenia	Equatorial Guinea	Macao
Australia	Eritrea	Macedonia
Austria	Estonia	Madagascar
Azerbaijan	Ethiopia	Malawi
Bahamas	Fiji	Malaysia
Bahrain	Finland	Maldives
Bangladesh	France	Mali
Barbados	Gabon	Malta
Belarus	Gambia, The	Mauritania
Belgium	Georgia	Mauritius
Belgium-Luxembourg	Germany	Mexico
Belize	Ghana	Micronesia, Fed. St
Benin	Greece	Moldova
Bermuda	Grenada	Mongolia
Bhutan	Guatemala	Morocco
Bolivia	Guinea	Mozambique
Bosnia and Herzegovina	Guinea-Bissau	Namibia
Botswana	Guyana	Nepal
Brazil	Haiti	Netherlands
Brunei	Honduras	Netherlands Antille
Bulgaria	Hong Kong	New Zealand
Burkina Faso	Hungary	Nicaragua
Burundi	Iceland	Niger
Cambodia	India	Nigeria
Cameroon	Indonesia	Norway
Canada	Iran	Oman
Cape Verde	Iraq	Pakistan
Central African Republic	Ireland	Palau
Chad	Israel	Panama
Chile	Italy	Papua New Guinea
China	Jamaica	Paraguay
Colombia	Japan	Peru
Comoros	Jordan	Philippines
Congo, Dem. Rep.	Kazakhstan	Poland
Congo, Republic of	Kenya	Portugal
Costa Rica	Kiribati	Puerto Rico
Cote d`Ivoire	Korea, Dem. Rep.	Qatar
Croatia	Korea, Republic of	Romania
Cuba	Kuwait	Russia
Cyprus	Kyrgyzstan	Rwanda
Czech Republic	Laos	
Denmark	Latvia	

Table 13 Continued

Samoa
Sao Tome and Principe
Saudi Arabia
Senegal
Serbia and Montenegro
Seychelles
Sierra Leone
Singapore
Slovak Republic
Slovenia
Solomon Islands
Somalia
South Africa
Spain
Sri Lanka
St. Kitts & Nevis
St. Lucia
St.Vincent & Grenadines
Sudan
Suriname
Swaziland
Sweden
Switzerland
Syria
Taiwan
Tajikistan
Tanzania
Thailand
Togo
Tonga
Trinidad &Tobago
Tunisia
Turkey
Turkmenistan
Uganda
Ukraine
United Arab Emirates
United Kingdom
United States
Uruguay
Uzbekistan
Vanuatu
Venezuela
Vietnam
Yemen
Zambia
Zimbabwe
French Guiana
Greenland

References

Alesina, Alberto, Robert Barro, and Silvana Tenreyro. "Optimal Currency Areas." NBER Working Paper Series Working Paper 9072 (2002).

Alesina, Alberto, Enrico Spolaore, and Romain Wacziarg. "Trade, Growth, and the Size of Countries." Harvard Institute of Economic Research Working Papers Working Paper 1995 (2002).

Anderson, James. "A Theoretical Foundation for the Gravity Equation." American Economic Review 69 (1979): 106-116.

Anderson, James, and Eric Van Wincoop. "Gravity with Gravitas: A Solution to the Border Puzzle." Boston College Working Papers Working Paper 485 (2000).

Arellano, Manuel, and Stephen Bond. "Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations." Review of Economic Studies 58 (1991): 277-297.

Baier, Scott, Jeffrey Bergstrand, and Peter Egger. "The New Regionalism: Causes and Consequences." Économie Internationale 109 (2007): 9-29.

Barro, Robert, and David Gordon. "A Positive Theory of Monetary Policy in a Natural Rate Model." Journal of Political Economy 91 (1983): 589-610.

Bergstrand, Jeffrey. "The Gravity Equation in International Trade: Some Microeconomic Foundations and Empirical Evidence." Review of Economics and Statistics 67 (1985): 474-481.

Bergstrand, Jeffrey. "The Generalized Gravity Equation, Monopolistic Competition, and the Factor-Proportions Theory in International Trade." Review of Economics and Statistics 71 (1989): 143-153.

Deardorff, Alan. "Determinants of Bilateral Trade: Does Gravity work in a Neoclassical World?" NBER Working Paper Series Working Paper 5377 (1983).

Eichengreen, Barry. "Should the Maastricht Treaty be Saved?" In Frankel, Jeffrey, and Andrew Rose. Economic Journal 108 (1998): 1009-1025.

Frankel, Jeffrey, and Andrew Rose. "The Endogeneity of the Optimum Currency Area Criteria." Economic Journal 108 (1998): 1009-1025.

Greene, William. Econometric Analysis: 5th Edition. New Jersey: Pearson, 2003.

Kenen, Peter. "The Theory of Optimum Currency Areas: an Eclectic View." In Frankel, Jeffrey and Andrew Rose. Economic Journal 108 (1998): 1009-1025.

Krugman, Paul. "Lessons of Massachusetts for EMU." In Frankel, Jeffrey and Andrew Rose. Economic Journal 108 (1998): 1009-1025.

McCallum, John. "National Borders Matter: Canada-U.S. Regional Trade Patterns." American Economic Review 85 (1995): 615-623.

Mundell, Robert. "A Theory of Optimal Currency Areas." American Economic Review 51 (1961): 509-517.

Persson, Torsten. “Currency Union and Trade: How Large is the Treatment Effect?” Economic Policy 33 (2001): 433-448.

Quah, Danny. “One Money, One Market: Estimating The Effect of Common Currencies on Trade.” In Rose, Andrew. Economic Policy 15.30 (2000): 7-45.

Rose, Andrew. “One Money, One Market: Estimating The Effect of Common Currencies on Trade.” Economic Policy 15.30 (2000): 7-45.

Rose, Andrew, and Eric Van Wincoop. “National Money as a Barrier to International Trade: The Real Case for Currency Union.” American Economic Review 91.2 (2001): 386-390.

The Coming Chinese Century: Boon or Bane for Southeast Asia?

Geoffrey (Kok Heng) See[1]
University of Pennsylvania

Abstract

China's explosive growth in recent decades has come with the fear that its cheap labor, together with its increasing prowess in science and technology, will crowd out Southeast Asian economies in both the high value-added end of the economic ladder as well as in the low value-added manufacturing sector. However, there is another view of China that rejects this new economic paradigm and the zero-sum game it implies. Here, the theory of comparative advantage in trade still holds, and instead of an economic competitor dominating the entire economic ladder, it is argued that there are complementarities in economies that allow all parties to benefit from increased consumption. Under this view, the increased consumption of the newly prosperous Chinese consumers and of the burgeoning Chinese market will enable Southeast Asian countries to prosper from trade with China. This paper evaluates each of these viewpoints, arriving at mixed results. While there is some evidence of trade competition, data also suggests the existence of economic complementation, with Chinese growth providing opportunities for increased growth and economic integration within Southeast Asia. Furthermore, the varied economic structures of Southeast Asia mean that this impact could be different among the individual countries in this region.

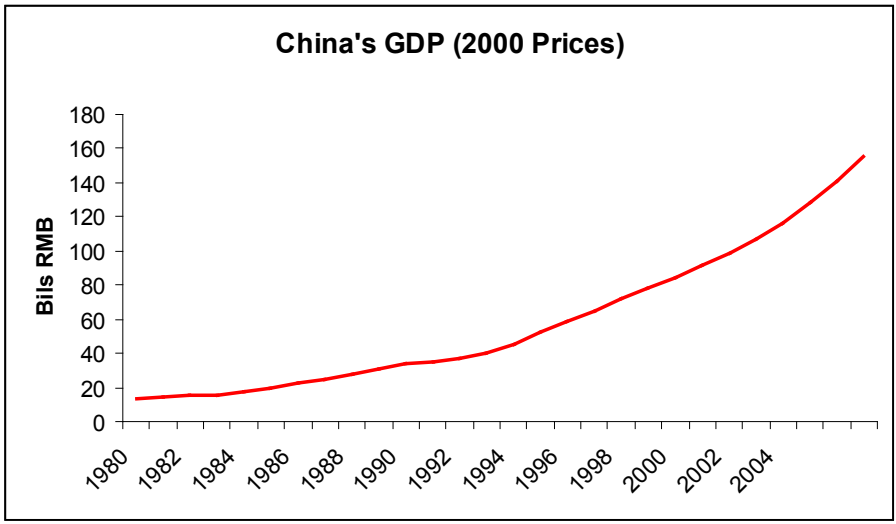
---

[1] Geoffrey (Kok Heng) See is a Wharton Research Scholar and Joseph Wharton Scholar pursuing a Bachelor of Science in Economics at the Wharton School, University of Pennsylvania. His research interests include political economy, the role of business in development, and transitional economies. He would like to thank Stephen J. Kobrin, William H. Wurster Professor of Multinational Management at the Wharton School for comments on the paper. Comments are welcome at **seeh@wharton.upenn.edu** or at **www.oikono.com**.

A Summary of China's Economic Transformation

In 1978, under Deng Xiaoping's leadership, China began a series of economic reforms that generated spectacular economic growth (see Figure 1). Since the reforms began, China's GDP has grown at an impressive rate of 9.4 percent per annum (p.a.) in real terms. Additionally, real GDP per capita has risen by more than six-fold and a predominantly agrarian society has become heavily industrialized.[2]

Figure 1: China's GDP at constant prices



Source: Compiled from International Financial Statistics

Prior to the reforms, China was a planned economy with a growth rate of 5 percent p.a. between 1960 and 1981.[3] The growth rate distinctly decelerated from the 8.88 percent p.a. from 1952 to 1957, though this deceleration fails to capture poor performance on other social indicators that were affected by the disruption caused by the Cultural Revolution in 1966.

China's 1978 economic overhaul had three starting points: the reorganization of farming, the increased autonomy given to State-Owned Enterprises

[2] Liang, Hong and Eva Yi. "China's Ascent: Can the Middle Kingdom Meet Its Dreams? (Global Economics Paper 133)." Goldman Sachs Global Economic. 2005.

[3] Nolan, Peter and Robert F. Ash. "China's Economy on the Eve of Reform." The China Quarterly 144: China's Transitional Economy (1995) 980-998.

(SOEs), and an expansion of Township and Village Enterprises (TVEs).[4] The marketization of the Chinese economy produced productivity gains that accounted for more than 42 percent of China's growth between 1979 and 1994.[5] This pool of "reform reservoir" still exists, and supports the rapid pace of growth of the Chinese economy today.

In the early 1980s, agricultural collectives were replaced by family farms.[6] This change only codified the unofficial change that began in the early 1970s which saw increased autonomy for collective farms. At the same time, TVEs were expanding in the 1980s. Since local political leaders frequently ran TVEs, the incentives of these leaders with were aligned with the momentum for economic reforms.[7] The TVEs also played a vital role in China's development of a manufacturing base from 1985 to the early 1990s.[8] At the state-level, the Contract Responsibility System was implemented in the mid 1980s, paving the way for greater independence of the SOEs.

As China's productivity soared, it also opened up to world trade by accepting foreign direct investments; first in the "special economic zones" enclave and later more broadly across the country. These zones supported export-oriented industries, and this export-dependence is reminiscent of the East Asian Economic Model: the export-led development path that South Korea, Japan, Singapore and Hong Kong treaded upon in the years preceding China's economic reforms.[9]

Many of the Southeast Asian economies, along with the economies

---

[4] Lindbeck, Assar. "An Essay on Economic Reforms and Social Change in China (Policy Research Working Paper No. 4057)." World Bank, Washington D.C. 2006.

State-Owned Enterprises refer to companies that are owned by the state, while Township and Village Enterprises refer to entrepreneurial communities based in villages and towns, often run by a government official, that were set up after market-based reforms began in China.

[5] Hu, Zuliu and Mohsin S. Khan. "Why is China Growing So Fast? (Working Paper No. 96/75)." International Monetary Fund. 1996.

[6] Zhou, Kate Xiao. How the Farmers Changed China: Power of the People. Boulder, CO: Westview Press, 1996.

[7] Cai, Hongbin and Daniel Treisman. "Did government decentralization cause China's economic miracle?" World Politics 58.4 (2006).

[8] Lindbeck, Assar, Ibid.

[9] The export-led growth model referred to here is economic growth that is predominantly driven by a growth in exports in the manufacturing sector.

of Hong Kong, South Korea and Japan, are still heavily export-dependent.[10] Traditionally, it was expected that as countries became more prosperous, they would move up an "economic ladder" and engage in more high value-added economic activities that resided in countries with competitive advantages of a highly educated workforce and advanced infrastructure of legal systems and governance. With the advent of China's explosive economic growth, there is a fear that its cheap labor, along with its increasing science and technology prowess, will increasingly crowd out these countries' economies in both the high value-added end of the economic ladder, *as well as* in the low value-added manufacturing sector.[11]

Another view of China rejects this new economic paradigm and the zero-sum game it implies. The theory of comparative advantage in trade still holds, and instead of an economic competitor dominating the entire economic ladder, it is argued that there are complementarities in economies that allow all parties to benefit from increased consumption.[12] Under this view, the increased consumption of newly prosperous Chinese consumers, and its burgeoning market, will enable Southeast Asian countries to prosper from trade with China.

This paper will examine whether China's economic rise is more of a blessing or a curse for Southeast Asia (SEA).[13] It looks at whether the traditional trade theory of comparative advantage no longer holds for SEA with China's rise. If China's labor wages are so depressed compared to the rest of SEA, and if it possesses technological prowess at the same time, China could

---

[10] He, Dong, Lilian Cheung, and Jian Chang. "Sense and Nonsense on Aisa's Export Dependency and the Decoupling Thesis (Working Paper No. 03/2007)." Hong Kong Monetary Authority Research Department. 2007.
The authors note that there is significance variance in export dependence over the last 10 years, although much of the variance can be attributed to the Asian Financial Crisis.

[11] Rodrik, Dani. "What's so Special About China's Exports? (Paper prepared for project on 'China and the Global Economy 2010')." China Economic Research and Advisory Programme, Harvard University. Jan. 2006.
Rodrik argues that China's exports are highly sophisticated and comparable to OECD exports, posing a significant threat along all levels of the manufacturing chain.

[12] Trade theory is based on absolute and comparative advantage in production. Under comparative advantage, countries trade because their *opportunity cost* of producing one item is greater than that of their partners.

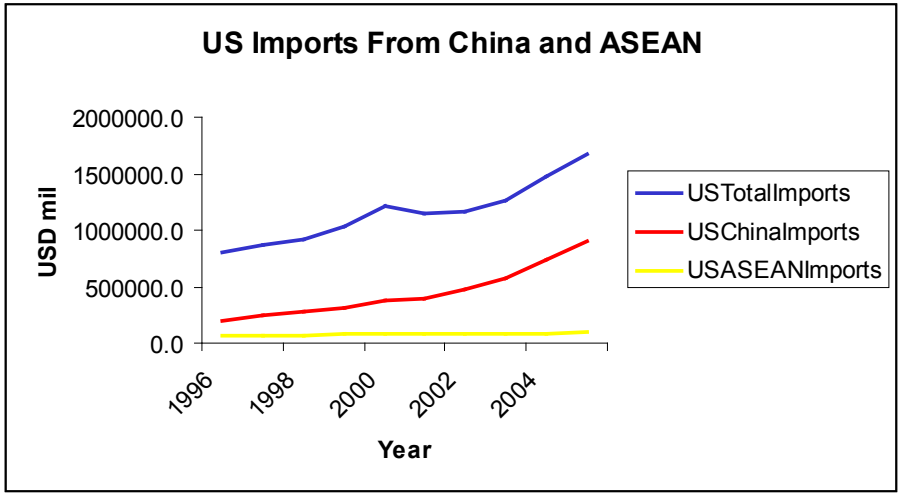
[13] The SEA grouping of countries used in this analysis focuses on the main economies of the region such as Indonesia, Malaysia, Thailand, Singapore and Vietnam. However, macro-data on the region also includes Laos PDR, Brunei, Burma (Myanmar) and Cambodia.

displace SEA completely in the export markets of the United States and the European Union in both sophisticated and non-sophisticated product categories. If traditional comparative advantage still holds, then SEA should be able to find export niches. If these niches exist for SEA, SEA can benefit from China's growth by meeting China's consumption needs.

Loss of Market Share from Competition *and* Trade Diversion

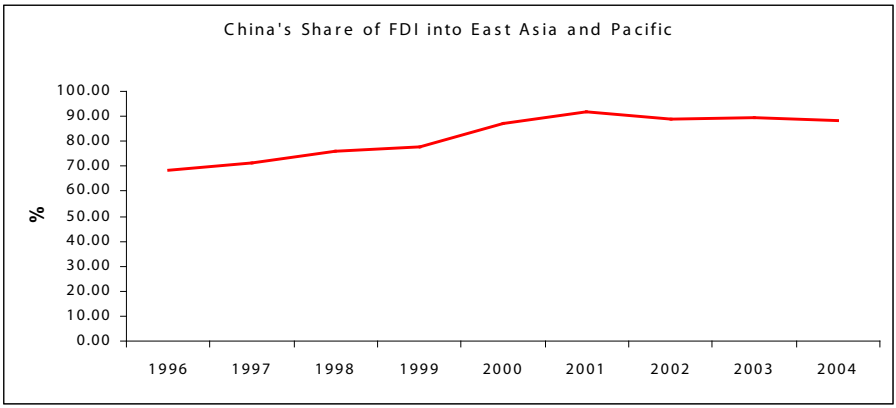
Looking at trade data (see Figure 2) and FDI data (see Figure 3), it would appear as if China is a black hole, sucking out FDI and export market share to the US from SEA. Both of these views over-simplify the complex trade and investment dynamics between SEA and China. The decrease in SEA's share of US trade can be broken down into a competitive effect and a diversion effect. The former represents the share of SEA trade "lost" to China, while the latter represents output that is going to China for assembly before re-export to the US. This trade artificially boosts China's export figures to the US while depressing those of SEA, though even the "lost" trade is not totally lost since rising Chinese incomes leads to increased Chinese consumption and trade with the region.

Figure 2



Source: Compiled from CEIC database.

Figure 3



Source: Compiled from CEIC database.

The huge arbitrage opportunities of low Chinese labor wages have altered production patterns in the region to give rise to this misleading statistic of Chinese export hegemony. There is increasing vertical specialization in production lines as companies take advantage of low labor costs by outsourcing labor-intensive assembly work to China. Some of China's export growth can be explained by its assembly of intermediate goods produced by SEA which are then exported to the US. Assembly work comprises the low value-added components of the supply chain, and its migration to China could allow SEA to focus more on higher value-added products, benefiting both countries.

Increasing vertical specialization is seen in the increased ratio of imports for processing to total imports in China from 35 percent in the early 1990s to over 50 percent in 1997.[14] China's exports contain high import content, and this is borne out by China's increasing trade deficit with the rest of Asia.[15] Only 15 percent of the value of China's electronics and IT exports are added in China.[16] In 2006, China had a deficit of $92 billion in electronic components while maintaining a surplus in computers, video cameras, televisions and telephones.[17] Intense competition for export markets between China

[14] Prasad, Eswar et. al. "China's Growth and Integration into the World Economy (IMF Occasional Paper No. 232)." International Monetary Fund, Washington, D.C. 2004.

[15] In 2006, China's trade deficit with East Asia reached $87.5 billion (Xinhua 2007).

[16] Branstetter, Lee, and Nicholas Lardy. "China's Embrace of Globalization (Working Paper No. 12373)." National Bureau of Economic Research. 2006.

[17] The Economist. Special report on Technology in India and China. Oct 27 – Nov 03 2007.

and SEA would also imply a strong negative correlation between China's and SEA's export rates, but this is not borne out in trade data.[18] Instead, the correlation is negligible.

Loss of export market share can also be attributed to the newly industrialized economies (NIEs) moving out of labor intensive, low value-added industries, into more capital-intensive industries or into services.[19] China's export gains come largely from taking over industries which NIEs were relinquishing. These export gains also have not come at the expense of the labor-intensive economies of the ASEAN-4, which it must in order to support the thesis of competition rather than complementation in economies.[20] From 1989 to 2002, the ASEAN-4 increased their percentage of exports to the US in 27 industries out of 52 categories, China in 42 industries and NIEs in 5 industries.[21] Gains by both the ASEAN-4 and China were made at the expense of the NIEs.

Although SEA faces some competition from China in both labor intensive and technologically sophisticated trade categories, it is found that within trade categories, technological sophistication offers some protection to ASEAN exporters.[22] China's technological sophistication is often over-exaggerated and China is still a place where electronic goods are made, not where much of the value is added.[23] A study of Apple's iPod revealed that the most expensive part of the iPod was manufactured in Japan, and China's role was mainly to assemble the pieces and test the product, which accounts for a mere $3.70 out of a $224 wholesale value.[24]

Complementary FDI Inflows Suggest Complementary Economies

As previously mentioned, popular perception compares China to a black hole that sucks in FDI. This assumes that SEA and China compete for the same product markets, and in doing so, chase the same FDI. However, China is a source of FDI creation for SEA, indicating that their economies complement each other.

---

[18] See "Table 1" in Appendix.

[19] This grouping of economies includes Singapore, Hong Kong, South Korea and Taiwan.

[20] This grouping of countries includes Malaysia, Thailand, Philippines and Indonesia.

[21] See "Table 2" in Appendix.

[22] Weiss, John. "People's Republic of China and its Neighbors: Partners or Competitors for Trade and Investment? (Research Paper Series No. 59)." Asian Development Bank, Tokyo, Japan. 2004.

[23] Economist Nov 10 2007 A special report on technology in India and China

[24] Linden, Greg, Kenneth L. Kraemer, and Jason Dedrick. "Who Captures Value in a Global Innovation System? The case of Apple's iPod." Personal Computing Industry Center. 2007.

Before examining the correlation between FDI into SEA and FDI into China, China's massive FDI inflows must be treated with caution. FDI into China is greatly exaggerated because of round tripping. Chinese firms, before China revamped its preferential tax treatment for foreign firms in 2007, often used holding companies abroad to carry their assets.[25] Earnings were repatriated abroad to benefit from the lower tax rate on foreign firms. These earnings returned as FDI and are estimated to account for 30 percent to 40 percent of total FDI inflows to China.[26]

FDI figures also appear much more modest after being adjusted for the size of China's economy. China receives far less FDI than SEA when FDI inflows are measured relative to the size of the economy. The 2002 UNCTAD FDI Performance Index, which compares FDI inflows to GDP, rates China at 1.2, which is only average for Asia and lower than Singapore, Malaysia or Thailand.[27] These figures used the reported FDI numbers unadjusted for round tripping, which indicates that Chinese actual FDI performance is even more dismal.

While China's attractiveness to FDI is overstated, it is still beneficial to SEA. China's FDI inflows are positively correlated with FDI inflows to ASEAN (Chantasasawat 2003).[28] This is explained by the increasingly integrated production lines in the region. FDI flows to one economy interact positively with FDI flows to another as international firms exploit production opportunities on a regional basis.

But The Economic Paradigm Could Still Change…

A closer look at FDI correlation and trade data in individual categories appears to support the thesis that SEA's economies complement China's. Instead of trade displacement across all export categories, China's rise has encouraged these economies to relinquish labor-intensive and low value-added manufacturing activities for capital-intensive and high value-added industries. Evidence also stems from the nature of exports to China: SEA increased exports

[25] In March 2007, China announced that corporate tax rates for foreign and domestic businesses will be unified (International Herald Tribune 2007).

[26] Xiao, Geng. "People's Republic of China's Round-Tripping FDI: Scale, Causes and Implications (ADB Institute Discussion Paper No. 7)." Asian Development Bank, Tokyo, Japan. 2004.

[27] UNCTAD 2002, Table 2.1.

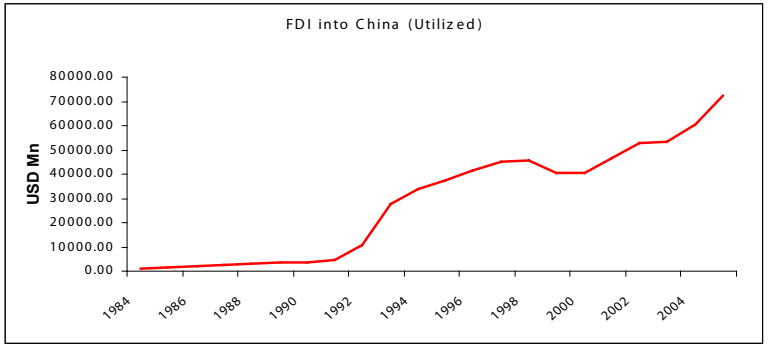
[28] Using a regression model comparing FDI inflow to ASEAN against some variables, including FDI inflows to China, the author found that a 10% increase in FDI to PRC raises FDI to elsewhere in region by 5-6%.

to China in relatively more skill-intensive activities from 1996 to 2000.[29]

These changes might have taken place eventually without China, but China has definitely made this change an urgent imperative. This shift in comparative advantage is positive and can be compared to Japan's development in the 1980s. NIEs flocked to take Japan's place in the flying geese formation[30] as Japan moved up the value chain into more innovative and technologically sophisticated industries, allowing material wellbeing to continue to improve.

Although China has not displaced SEA across the entire economic ladder in the past 20 years, this remains a possibility. FDI into China doubled this decade (see Figure 4) and China is likely to start shifting into more capital-intensive production categories. This trend is encouraged by the rising labor costs faced by China in the Pearl River Delta and Shanghai. China's competition for export markets has picked up in recent years, and from 2000 to 2002, it increased its market share in 40 out of 49 trade categories in the G3 market at the expense of *both* NIEs and ASEAN-4 (Ahearne et al. 2003).[31]

Figure 4



Source: Compiled from CEIC database.

[29] Roland-Holst, David and John Weiss. "People's Republic of China and its Neighbours: Evidence on regional trade and investment effects." Asian-Pacific Economic Literature 19.2 (2005): 18-35.
Applying a GTAP model, and making suitable adjustments, Roland and Holst (2003) found that in bilateral PRC-ASEAN trade on a skilled labor content basis, there was a substantial shift of 16% towards greater export orientation.

[30] Flying Geese Model, popularized by Japanese economist Kaname Akamatsu, postulates that Asian countries will catch up with the West in a tier-level; Japan being the lead goose, the "Asian Tigers" second, and the ASEAN countries being the third tier.

[31] Ahearne, Alan, John Fernald, Prakash Loungani, and John Schindler. "China and emerging Asia: Comrades or competitors? (Working Paper No. 2003-27)." Chicago Federal Reserve Bank. 2003.

China's entry into the World Trade Organization in 2001 also removed a lot of the risk stemming from its need to receive annual renewal of Most Favored Nation trade status with the United States. The reduced risk implies that firms that previously diversified their supply sources across Asia might seek to do the bulk of their production in China. The textile industry provides an example of how trade dynamics in the region can change. In December 2004, quotas on the export of textiles and clothing from developing countries were removed with the Agreement on Textiles and Clothing (ATC). It was expected that countries that benefited from the quotas, despite being uncompetitive competitors in the industry, would lose market share to countries with cost advantages in the industry. In particular, China was expected to be a primary beneficiary because of its cheap labor costs and modern mills.

As predicted, shortly after the removal of quotas, US imports of Chinese textiles rose 55.8 percent in 2005, while the rest of Asia saw their imports fall by 7.71 percent.[32] The market share for Asian producers, excluding China, fell by almost 3 percent between 2004 and 2005. EU imports of textiles from China grew 40.07 percent in 2005 against a 13.37 percent increase for Asia as a whole. Most of the rest of Asia suffered negative growth in their exports to the EU in this market. However, the risk of protectionism still exists, and the European Commission in the second quarter of 2005 began implementing special safeguards that limited imports on certain textile categories. The US sought to limit inroads by China into the textile markets in a trade memorandum that set out agreed levels of imports by volume over 2006-2008. These restrictions appear to benefit other Asian suppliers.[33] However, once these safeguards expire, it is likely that China will continue dominating this market. The case of textiles reveals how low labor costs and efficient production could allow China to become dominant in more trade categories over time. Nevertheless, textile is a labor-intensive and low-technology industry, and this example does not support the idea of China taking over the entire economic ladder.

China's Rising Affluence Can Drive Southeast Asian Growth

As economic niches for SEA exist even with China's rise, SEA can benefit from continued Chinese growth. By one estimate, China is expected to be the leading economic power by 2041 in terms of gross domestic output

[32] See "Table 3" in Appendix.

[33] "Asian Development Outlook 2006." Asian Development Bank, Tokyo, Japan. 2006.

unadjusted for purchasing power parity.[34] If measured on a purchasing power parity basis, it could attain this status even earlier. Rising affluence will lead to increased demand from Chinese consumers. Increased demand stems not only from a continuation of China's wealth buildup, but also from the formation of a true middle class between 2015 and 2025.[35] If SEA succeeds at raising the technological sophistication of their economies and finding the right niches, this rising tide will also lift their boats.[36]

Although Wilson's and Purushothaman's estimates are based on historical growth rates adjusted for demographic trends, they paint a picture for the potential of China's domestic consumption growth. There is no *economic reason* to expect China's growth to slow down short of geopolitical conflict or internal strife. The NIEs and Japan maintained stronger growth rates for over a 30-year period than China in her last decade. It is projected that China's GDP growth will average 7.2 percent in the next five years, fall to 5 percent in 2020 and slow to around 3.5 percent by the mid 2040s (see Table 1). These projections are based on middle-of-the-path estimates and the fact that China has exceeded the growth forecasts over the four years since the report's publication.

Table 1: Chinese Growth Rates

	Real GDP Growth: 5-yr Avg.	**GDP/Capita Growth: yoy**	
%	**China**	**China**	**US**
2000-2005	8.0	9.2	2.6
2005-2010	7.2	11.2	1.7
2010-2015	5.9	9.2	1.3
2015-2020	5.0	7.8	1.3
2020-2025	4.6	7.3	1.4
2025-2030	4.1	6.9	1.7
2030-2035	3.9	6.5	1.9
2035-2040	3.9	6.3	2.0
2040-2045	3.5	5.9	1.9
2045-2050	2.9	5.4	1.9

Source: Goldman Sachs Global Paper No.99 (Wilson and Purushothaman 2003)

[34] Wilson, Dominic and Roopa Purushothaman. "Dreaming with BRICs: The Path to 2050. (Global Economics Paper No. 99)." Goldman Sachs Economic Research. 2003.

[35] Farrell, Diana, Ulrich A. Gersch, and Elizabeth Stephenson. "The Value of China's emerging Middle Class." The Mckinsey Quarterly 2006 Special Edition (2006).

[36] Roland-Holst, David and John Weiss. "People's Republic of China and its Neighbours: Evidence on regional trade and investment effects." Asian-Pacific Economic Literature 19.2 (2005): 18-35.

China's unusually high growth is also sustainable because it is driven by increases in productivity. Economists have in recent times criticized the "inefficient" investments driving Chinese growth and argued that such growth is unsustainable.[37] The Cobb-Douglas function used for economic growth forecast in Goldman Sachs' report considers productivity, labor and capital as drivers of growth. If growth is driven by rising employment (e.g. through women entering the workforce), it is likely to slow as full employment, especially of scarce skilled labor, is achieved. The rising wages in coastal cities imply that the benefits of China's labor reserves are limited. If growth relies only on capital investments, growth will eventually decay to a steady-state level as the rate of capital depreciation grows to match investment levels. At the height of the Asian Miracle debate, economist Paul Krugman argued that the growth of the Asian Tigers was unsustainable as they were built on massive increases in employment and capital accumulation instead of on productivity improvements.[38]

Chinese growth has taken place on a firm foundation of rapid productivity increases and a slowdown in growth is unlikely to happen anytime soon. Total Factor Productivity (TFP) gains averaged 3.3 percent per annum from 1978 to 2004, and accounted for 36 percent of China's growth.[39] This compares favorably with TFP growth in the Asian Tigers at around 2 percent.[40] These rapid gains can be attributed to "reform dividends" from China's transition from central planning to a market system. There are still many reforms to be taken and TFP gains are likely to continue if the reforms are managed well.[41] As productivity gains factors heavily in the Chinese growth story, there is a stable foundation for future growth.[42]

Demand for imports from SEA will be driven by economic growth

[37] Wolf, Martin. "China has further to grow to catch up with the world." Financial Times 13 April 2005.

[38] Krugman, Paul. "The Myth of Asia's Miracle." Foreign Affairs (1994).

[39] Liang, Hong and Eva Yi. "China's Ascent: Can the Middle Kingdom Meet Its Dreams? (Global Economics Paper 133)." Goldman Sachs Global Economic. 2005.

[40] Young, Alwyn. "The Tyranny of Numbers: Confronting the Statistical Realities of the East Asian Growth Experience (NBER Working Paper No. W4680)." 1994. <http://ssrn.com/abstract=226946>.

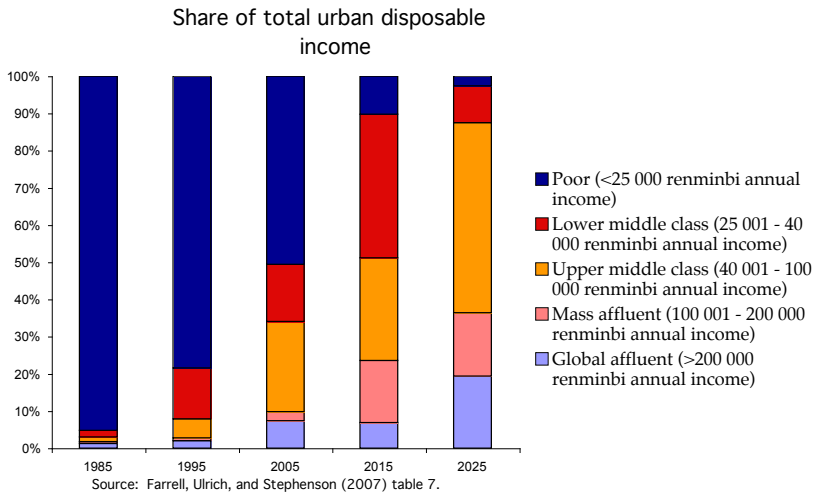
[41] Liang, Hong, Ibid.

[42] Goldman Sachs predictions of Chinese growth rate might have underestimated growth as it does not take into account this "reform reserve". It assumes that productivity increases are a function of income per-capita based on the experience of other countries. However, this reserve could lead to larger productivity increases for a given per-capita income in China.

and also by the development of a middle class in China. The development of an urban middle class in the next 20 years is a major demographic trend.[43] This new consumer group will demand higher consumption and will contribute to the demand of SEA's imports.

The McKinsey Global Institute (2006) projects the emergence of the urban middle class as a major consumer group from 2010 onwards. Comprised of working-class migrants into major cities, their population rose 15 percent in the last two years to reach 80 million.[44] By 2015, the disposable income of the middle-class is expected to be the largest among all consumer segments (see Figure 7). By 2025, the middle class will comprise 520 million people, and will possess 61 percent of China's national income.

Figure 7



Source: National Bureau of Statistics of China; McKinsey Global Institute analysis

A Rising Tide Lifts All Boats?

Trade data does not strongly suggest that China's growth has changed the fundamentals of economics and trade by dominating the entire economic ladder, leading to the displacement of SEA economies. Instead, a more nuanced picture has emerged suggesting economic complementation co-existing alongside limited competition. Although the effects vary across Southeast Asian economies, the decrease in exports to the US markets in various trade

[43] Farrell, Diana, Ulrich A. Gersch, and Elizabeth Stephenson. "The Value of China's emerging Middle Class." The Mckinsey Quarterly 2006 Special Edition (2006).

[44] These segment is defined as having RMB 60 000 to RMB 500 000 in annual income

categories are largely confined to the NIEs moving up the economic ladder to focus on more capital-intensive industries. Export figures also overstate the extent of China's trade with the US and understate that of Southeast Asia. Because final assembly of manufacturing components takes place in China, significant portions of the value-chain still remain within Southeast Asia.

There has also been no evidence so far that China is successfully competing for value-added activities at the upper regions of the economic ladder. However, this analysis examines the relationship between China's growth and Southeast Asia's economies for the past 20 years. A future study with the latest macro- and micro-economic data might be able to shed more light on whether the lack of economic displacement still holds and will continue to hold.

At the same time, Chinese growth provides opportunities for increased SEA growth and economic integration. SEA can benefit from increased exports to China as China's market grows. On the demand side, rapid Chinese growth and middle-class formation will lead to increased consumerism. Technological sophistication within a trade category has been shown to provide SEA with protection from Chinese competition. If SEA is able to find technologically advanced niches within this new global supply chain, they can benefit from China's growth. Roland-Holst (2002, 2003) forecasts imports by China from SEA to increase by 28% between 2002 and 2020.[45]

This paper studies Southeast Asia as a general economic bloc and largely considers trade data for the region as a whole. This sheds light on the macro-implication of Chinese growth on Southeast Asia. However, economies in the region range from developed Singapore to the transitional economy of Vietnam, and have widely varying levels of economic development. Given the variance in economic structures and standards of living in these countries, China's growth could have a different impact on individual countries in Southeast Asia. Further studies can be done to study the impact on individual countries in this bloc.

[45] Roland-Holst, David and John Weiss. "People's Republic of China and its Neighbours: Evidence on regional trade and investment effects." Asian-Pacific Economic Literature 19.2 (2005): 18-35.

Appendix

Table 1
Conditional Correlations between China's Real Export Growth and Real Export Growth in other Asian Economies

	NIEs (Korea, Singapore, Taiwan, Hong Kong)			ASEAN-4 (Indonesia, Malaysia, Philippines, Thailand)			All eight countries (NIEs plus ASEAN-4)		
Independent Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
China's Real Exports	0.29	0.03	0.08	0.48	0.22	0.11	0.38	0.11	0.13
	(0.08)	(0.10)	(0.10)	(0.11)	(0.13)	(0.13)	(0.07)	(0.08)	(0.09)
Lag 1	.	.	0.09	.	.	0.22	.	.	0.09
			(0.14)			(0.17)			(0.11)
Lag 2	.	.	-0.03	.	.	0.17	.	.	-0.01
			(0.13)			(0.19)			(0.13)
Foreign Demand		3.16	3.87		2.97	5.22		3.13	4.13
	.	(0.63)	(0.93)	.	(0.69)	(1.23)	.	(0.47)	(0.83)
Lag 1	.	.	-1.60	.	.	-0.04	.	.	-1.06
			(0.73)			(0.12)			(0.62)
Lag 2	.	.	1.16	.	.	0.03	.	.	0.58
			(0.54)			(0.81)			(0.55)
Real Exchange Rate		-0.38	-0.37		-0.32	-0.29		-0.33	-0.37
	.	(0.13)	(0.10)	.	(0.12)	(0.06)	.	(0.10)	(0.08)
Lag 1	.	.	-0.37	.	.	0.30	.	.	0.15
			(0.12)			(0.08)			(0.10)
Lag 2	.	.	-0.09	.	.	0.11	.	.	-0.05
			(0.14)			(0.08)			(0.07)
Lagged Dependent Variable	0.12	0.14	0.14	-0.08	-0.05	-0.02	-0.01	0.02	0.12
	(0.11)	(0.10)	(0.10)	(0.10)	(0.09)	(0.13)	(0.08)	(0.07)	(0.09)
Adjusted R^2	0.07	0.34	0.44	0.19	0.41	0.49	0.14	0.39	0.39

Note: Standard errors are in parenthesis. Regression estimated as a panel from 1981 – 2001. All regressions include country fixed effects (not shown). Data are from IFS and National Income accounts data from country sources.

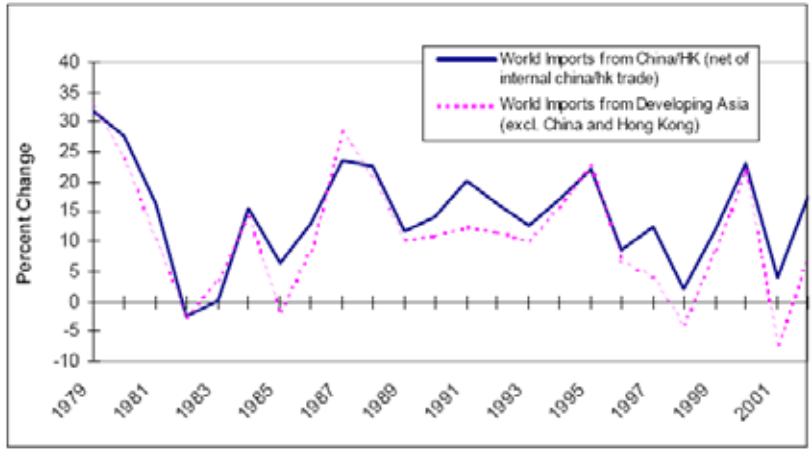
1. Regression of real export growth against (1) country fixed effects, (2) a lagged dependent variable and (3) China's real export growth.

Table 2: Shares in US Imports from Asia

End Use Code	1989 China	1989 NIE's	1989 ASEAN	2002 China	2002 NIE's	2002 ASEAN	Total Imports from Asia 2002 (US $ billions)
000	0	3	96	1	2	98	0.3
001	22	17	62	34	14	52	2.2
002	2	4	93	20	4	76	0.2
010	22	29	49	30	8	62	3.1
100	21	9	70	18	42	40	1.8
101	71	1	29	72	0	28	0.1
103	98	0	2	100	0	0	0.1
104	0	0	0	0	0	0	0.0
110	24	75	1	35	0	65	0.0
111	19	76	5	26	58	16	0.5
120	13	5	82	25	5	69	1.3
121	29	56	16	28	55	17	3.0
123	16	37	46	8	84	8	0.1
125	22	70	9	44	39	17	3.2
130	2	28	70	58	6	36	1.5
131	8	75	17	62	12	27	1.5
140	68	5	27	79	14	7	0.1
141	1	96	3	17	71	12	0.9
142	52	14	33	60	30	11	0.4
150	10	80	10	33	55	11	0.8
151	12	86	3	36	61	3	1.8
152	18	78	4	56	36	8	1.5
160	63	19	18	65	30	6	0.2
161	23	67	10	48	44	9	4.4
200	22	70	8	55	31	14	8.3
210	4	75	21	36	54	10	0.7
211	16	82	2	50	44	6	9.9
212	11	86	4	52	45	3	0.3
213	7	72	21	24	42	34	67.8
214	21	66	13	39	30	31	7.8
215	28	66	6	72	14	14	1.8
216	20	49	31	37	31	32	2.8
220	10	86	4	22	72	6	0.5
221	16	83	2	73	26	1	0.0
222	11	83	6	37	55	8	0.1
223	0	100	0	14	22	64	0.0
300	0	100	0	0	100	0	6.9
301	0	99	0	70	28	2	0.0
302	11	75	13	34	43	23	6.5
400	36	52	12	69	12	20	41.1
401	46	46	8	64	30	5	6.5
410	24	66	10	67	22	11	38.8
411	38	57	5	84	11	6	19.4
412	19	64	18	53	17	30	17.1
413	48	23	29	67	5	28	4.0
420	16	40	45	34	39	27	0.0
421	34	38	28	71	10	19	1.2
500	27	58	15	34	47	19	5.9

Source: China and Emerging Asia: Comrades or Competitors? (WP 2003-27)
Alan G. Ahearne, John G. Fernald, Prakash Loungani and John W. Schindler

Figure 1:
Exports from Greater China and from Developing Asia



Note: The solid line shows recorded imports by all countries in the world from either China or Hong Kong, excluding China's imports from Hong Kong and Hong Kong's imports from China. The dashed line shows imports by all countries in the world from developing Asian economies other than China or Hong Kong. Data source is IMF's Direction of Trade Statistics.

Source: China and Emerging Asia: Comrades or Competitors Alan G. Ahearne et al.

Table 3: United States imports of clothing, by volume

	Volume change over prev. year (%)				Market share (%)			
	2002	**2003**	**2004**	**2005**	**2002**	**2003**	**2004**	**2005**
Asia Pacific DMC suppliers	**12.88**	**14.73**	**10.4**	**21.87**	**49.75**	**52.21**	**55.01**	**63.05**
People's Republic of China	**60.35**	**46.32**	**29.81**	**97.93**	**9.07**	**12.14**	**14.9**	**26.73**
Asia Pacfic excluding PRC	**5.89**	**7.69**	**5.86**	**-0.09**	**40.68**	**40.07**	**40.11**	**36.32**
World	**7.15**	**9.32**	**5.76**	**10.32**	**100**	**100**	**100**	**100**

Source: United States Dept. of Commerce, Office of Textiles and Apparel.
< http://www.adb.org/Documents/books/ado/2006/part010403.asp>

References

Ahearne, Alan, John Fernald, Prakash Loungani, and John Schindler. "China and emerging Asia: Comrades or competitors? (Working Paper No. 2003-27)." Chicago Federal Reserve Bank. 2003.

"Asian Development Outlook 2006." Asian Development Bank, Tokyo, Japan. 2006.

Branstetter, Lee, and Nicholas Lardy. "China's Embrace of Globalization (Working Paper No. 12373)." National Bureau of Economic Research. 2006.

Cai, Hongbin and Daniel Treisman. "Did government decentralization cause China's economic miracle?" World Politics 58.4 (2006).

Farrell, Diana, Ulrich A. Gersch, and Elizabeth Stephenson. "The Value of China's emerging Middle Class." The Mckinsey Quarterly 2006 Special Edition (2006).

He, Dong, Lilian Cheung, and Jian Chang. "Sense and Nonsense on Aisa's Export Dependency and the Decoupling Thesis (Working Paper No. 03/2007)." Hong Kong Monetary Authority Research Department. 2007.

Hu, Zuliu and Mohsin S. Khan. "Why is China Growing So Fast? (Working Paper No. 96/75)." International Monetary Fund. 1996.

"Chinese tax change could raise bill for foreign firms by $5.5 billion." International Herald Tribune. 9 March 2007.

Johnson, D. Gale. "China's Rural and Agricultural Reforms: Successes and Failures (Working Paper No. 96/12)." Chinese Economics Research Centre, University of Adelaide. 1996.

"China's Rural and Agriculture Reforms in Perspective." Land Tenure, Land Market, and Productivity in Rural China Workshop, Beijing. 16 May 1998.

Krugman, Paul. "The Myth of Asia's Miracle." Foreign Affairs (1994).

Liang, Hong and Eva Yi. "China's Ascent: Can the Middle Kingdom Meet Its Dreams? (Global Economics Paper 133)." Goldman Sachs Global Economic. 2005.

Lindbeck, Assar. "An Essay on Economic Reforms and Social Change in China (Policy Research Working Paper No. 4057)." World Bank, Washington D.C. 2006.

Linden, Greg, Kenneth L. Kraemer, and Jason Dedrick. "Who Captures Value in a Global Innovation System? The case of Apple's iPod." Personal Computing Industry Center. 2007.

Nolan, Peter and Robert F. Ash. "China's Economy on the Eve of Reform." The China Quarterly 144: China's Transitional Economy (1995) 980-998.

Prasad, Eswar et. al. "China's Growth and Integration into the World Economy (IMF Occasional Paper No. 232)." International Monetary Fund, Washington, D.C. 2004.

Rodrik, Dani. "What's so Special About China's Exports? (Paper prepared for project on 'China and the Global Economy 2010')." China Economic Research and Advisory Programme, Harvard University. Jan. 2006.

Roland-Holst, David and John Weiss. "People's Republic of China and its Neighbours: Evidence on regional trade and investment effects." Asian-Pacific Economic Literature 19.2 (2005): 18-35.

Weiss, John. "People's Republic of China and its Neighbors: Partners or Competitors for Trade and Investment? (Research Paper Series No. 59)." Asian Development Bank, Tokyo, Japan. 2004.

Wilson, Dominic and Roopa Purushothaman. "Dreaming with BRICs: The Path to 2050. (Global Economics Paper No. 99)." Goldman Sachs Economic Research. 2003.

Wolf, Martin. "China has further to grow to catch up with the world." Financial Times 13 April 2005.

Xiao, Geng. "People's Republic of China's Round-Tripping FDI: Scale, Causes and Implications (ADB Institute Discussion Paper No. 7)." Asian Development Bank, Tokyo, Japan. 2004.

"China's trade deficit with East Asia hits $87.5b (Xinhua Press Release)." Xinhua News Agency 15 July 2007.

Young, Alwyn. "The Tyranny of Numbers: Confronting the Statistical Realities of the East Asian Growth Experience (NBER Working Paper No. W4680)." 1994. <http://ssrn.com/abstract=226946>.

Zhou, Kate Xiao. How the Farmers Changed China: Power of the People. Boulder, CO: Westview Press, 1996.

Databases Used:

Handbook of Statistics 2002. United Nations Conference on Trade and Development.

International Financial Statistics. International Monetary Fund.

Emerging Markets Database. CEIC Data Company.

Greater Equivalency of High School Equivalents? A Study of GEDs and Their Effect on Labor Market Status

Diana Trebino[1]
Middlebury College

Abstract

Using the National Longitudinal Survey of Youth (NLSY) data from 1978, Cameron and Heckman found that GED recipients are indistinguishable from high school dropouts in labor market status. I use more recent data from the 1999-2006, the Current Population Survey (CPS), to provide evidence that GED recipients do earn higher wages than high school dropouts and that GED attainment is associated with greater wage boosts for those who drop out before attending high school. Additional findings suggest that the GED plays little role in labor force participation and employment, but it may help increase one's chances of being in a higher-paying occupation. This suggests that in more recent years, the GED has offered greater benefits in the labor market.

[1] Diana Trebino is a senior at Middlebury College, majoring in economics. Questions and comments are welcome at **dtrebino@middlebury.edu**. She would like to thank Caitlin Myers, Assistant Professor of Economics at Middlebury College. Her guidance was crucial in the implementation and write-up of this study. She would also like to thank her classmates Michelle Constant, Sean Meany, and George Baumann for offering beneficial advice throughout this process.

I. Introduction

Forty-four years ago, every state had moved to acceptance of the General Education Development Tests as a high school graduation credential. The GED became an important element of the educational system and sparked debate of how attainment of this high school "equivalent" affects one's labor market status.

Human capital has always been viewed as a vital component of the labor market. Ashenfelter and Rouse (1998) estimate that the average return to schooling is about 9 percent per year when obtained for a sample of genetically identical individuals and that the return to schooling is slightly lower for people with higher ability.[2] There still remains the disputed question of to what extent these returns are due to human capital acquisition and to what extent they are due to the signaling value of educational credentials. Jaeger and Page (1996) look at the signaling value of diplomas and find that there are significant effects on wages for high school diploma recipients among white males.[3] Whether GEDs serve as this signal or as a means to gain human capital, there still remains the question of how this credential translates in the labor market.

The GED exam began in the early 1940s during World War II. Many men enrolled in the army did not have high school diplomas because they had dropped out to join the military.[4] Without a diploma, these men could not enter college without special deals. As a result, in 1942, the Advisory Committee to the Army Institute chose five different tests from the Iowa Test of Educational Development to become the first General Educational Development Tests.[5] By 1963, all 50 states accepted the GED exam as a high school graduation credential. The GED is comprised of five different subject tests, including writing skills, social studies, science, reading skills, and mathematics. Each state sets its own passing standards.[6]

---

[2] Ashenfelter, Orley, and Cecilia Rouse. "Income, Schooling, and Ability: Evidence From a New Sample of Identical Twins." The Quarterly Journal of Economics, 113, 1998.

[3] Jaeger, David A., and Marianne E. Page. "Degrees Matter: New Evidence on Sheepskin Effects in the Returns to Education." The Review of Economics and Statistics, 4, 1996.

[4] Boesel, David, Nabeel Alsalam, and Thomas Smith. "Research Synthesis: Educational and Labor Market Performance of GED Recipients." U.S. Department of Education. 1998. <http://www.ed.gov/PDFDocs/GED/gedfront.pdf >.

[5] Ibid.

[6] Cameron, Stephen V., and James J. Heckman. "The Nonequivalence of High School Equivalents." Journal of Labor Economics, 11, 1993.

Most people who take the GED Test are less than twenty-five years old.[7] In 1995, GED test takers had finished an average of 9.9 years of schooling. Passing rates for the exam have generally been between 70-80 percent.[8] GED recipients are observably different from non-recipient dropouts and those with a high school diploma. Relative to non-recipient dropouts, people with a GED have, on average, more years of schooling before dropping out of high school, higher levels of measured cognitive skill, higher family income, and higher levels of parental education.[9] Relative to high school graduates, GED recipients have, on average, 2.1 fewer years of schooling, or about 861 fewer hours of core curriculum classes.[10] Because GED recipients have considerably less class-time, on average, it is not clear that the GED truly is "equivalent" to a diploma.

I base this work on a prominent study by Cameron and Heckman (1993) that used National Longitudinal Survey of Youth (NLSY) data for males between the ages of 13-20 in 1978. Cameron and Heckman find that at age 25, the mean labor market status of high school dropouts is the same as the status of GED recipients. [11] Both of these groups are inferior to high school diploma recipients regarding hours worked, wages, salaries, weeks worked, and length of time at job. Cameron and Heckman then interact GED variables with years of completed schooling. They find that GED recipients and dropouts with the same years of schooling earn the same wages. However, high school graduates earn statistically significant higher wages only when compared to GED recipients or dropouts with 10 or fewer years of schooling. High school graduates compared to GED recipients or dropouts with 11 years of schooling are indistinguishable. This result could favor the argument for human capital. Since individuals with the diploma credential only have higher wages in comparison to GED recipients or dropouts with fewer years of schooling (but not to those with similar years of schooling), this could suggest that higher wages are a result of human capital acquisition.

---

[7] Cameron, Stephen V., and James J. Heckman. "The Nonequivalence of High School Equivalents." Journal of Labor Economics, 11, 1993.

[8] Boesel, David, Nabeel Alsalam, and Thomas Smith. "Research Synthesis: Educational and Labor Market Performance of GED Recipients." U.S. Department of Education. 1998. <http://www.ed.gov/PDFDocs/GED/gedfront.pdf >.

[9] Tyler, John H., Richard J. Murnane, and John B. Willett. "Estimating the Labor Market Signaling Value of the GED." The Quarterly Journal of Economics, 115, 2000(b

[10] Boesel, David, Ibid.

[11] Cameron, Stephen V., Ibid.

Other studies of the returns to the GED are not consistent with Cameron and Heckman. Tyler, Murnane, and Willett (2000 b) observe only young white dropouts on the margin of passing the GED exam in 1990.[12] The study finds that the signaling value of the GED increased 1995 earnings of young white dropouts on the margin of passing these exams by 10-19 percent, possibly suggesting that GED effects are concentrated among the least skilled dropouts. Another study done by Tyler, Murnane, and Willett (2000 a) divides those who took the GED according to their score on the test.[13] It finds that for all demographic groups except for white males, higher GED scores are associated with higher earnings.

This paper updates Cameron and Heckman's study and provides contrasting results. While Cameron and Heckman use NLSY data from 1978, I update this study by using CPS data from 1999-2006 to provide evidence on the effect of the GED in more recent years. I also modify the model by including another variable - highest grade completed by individual - which will control for educational level effects. I find that GED recipients do earn higher wages than dropouts and that the GED helps eighth grade dropouts more than twelfth grade dropouts. Also, this study finds that the GED is insignificant when it comes to affecting labor force participation and employment but may increase one's chances of being in a higher-paying occupation. This could mean that the labor market has changed or that perhaps the human capital gains or signaling that result from GED attainment have begun to play more of a role in the labor market in more recent years. These results provide evidence that this high school "equivalent" might actually be advantageous for labor market outcomes.

II. Data and Theoretical Models

The data used for this study are from the Current Population Survey conducted by the U.S. Bureau of Labor Statistics. The sample is limited to male U.S. citizens from ages 25-65 from the years 1999-2006. I chose this age limit because it allows the individuals in the sample to have received their GED and started working while eliminating men of retirement age. Male U.S. citizens were chosen to eliminate the effect of immigration in the labor force and because males generally have a more continuous employment record than

[12] Tyler, John H., Richard J. Murnane, and John B. Willett. "Estimating the Labor Market Signaling Value of the GED." The Quarterly Journal of Economics, 115, 2000(b).

[13] Tyler, John H., Richard J. Murnane, and John B. Willett. "Do the Cognitive Skills of School Dropouts Matter in the Labor Market?" The Journal of Human Resources, 35, 2000(a).

females. The sample is further limited to respondents who left school prior to obtaining a diploma, who have a GED, or who received a high school diploma. There are no individuals in the sample who have gone beyond the GED to receive higher education.

Tables 1 and 2 provide summary statistics for the sample used in this study.[14] Table 1 indicates that the mean hourly wage is $17.71 in 2006 dollars. Each grade level variable indicates the highest grade level attained by the individual. Twenty-two percent of the sample are non-GED recipient dropouts, 9 percent have a GED, and 69 percent have a diploma. Table 2 reports mean GED attainment by grade level. Eleven percent of 8th grade dropouts have obtained a GED while 38 percent of 11th grade dropouts have done so.

Models:

Model 1 estimates the effect of GED attainment on wages controlling for the number of years of schooling completed, where effects are relative to high school diploma recipients. In addition to the educational variables of interest, **X** includes controls for age, race, geographical location, marital status, children, government employment, occupation, industry, and year variables. The coefficient of each grade level indicates the percent difference in wages that dropouts (of that certain grade level with no GED) earn in relation to diploma recipients. The coefficient of the GED variable adds to each of the grade level coefficients to indicate the percent difference in wages of dropouts (of that certain grade level with a GED) in relation to diploma recipients.

$$\begin{aligned}\text{Log(wage)} = (\alpha X) + \beta_1 \text{grade8} + \beta_2 \text{grade9} + \beta_3 \text{gradel0} + \beta_4 \text{gradel1} + \\ \beta_5 \text{gradel2} + \beta_6 \text{GED} + \varepsilon\end{aligned} \quad (1)$$

In Model 2, I interact grade level with GED. To determine the effect on wages of obtaining a GED, the coefficient of each grade level must be added to the coefficient of GED and to the coefficient of each interaction term. This allows for changing effects by grade level.

$$\begin{aligned}\text{Log(wage)} = (\alpha X) + \beta_1 \text{grade8} + \beta_2 \text{grade9} + \beta_3 \text{gradel0} + \beta_4 \text{gradel1} + \\ \beta_5 \text{gradel2} + \beta_6 \text{GED} + \beta_7 \text{ged} \times \text{grade9} + \beta_8 \text{ged} \times \text{gradel0} + \beta_9 \text{ged} \times \text{gradel1} + \\ \beta_{10} \text{ged} \times \text{gradel2} + \varepsilon\end{aligned} \quad (2)$$

Model 3 is a probit model of labor force non-participation. It uses the same independent variables as Model 1 to determine the effect of the GED on the likelihood of being in the labor force. Model 4 is a similar probit that tests whether or not an individual is more or less likely to be employed, using the

[14] Wages below the federal minimum of $2.13 were dropped.

same independent variables as Model 1 but limiting the sample to those in the labor force.

Finally, I run probits that test the effect of GED attainment on the likelihood of being in a certain occupation. I use the same variables as the above models. Occupations include: professional, managerial, and technical, services, sales, blue collar, farming, and labor.

III. Results

Model 1 estimates the effect of GED attainment on wages controlling for the number of years of schooling completed. Effects are relative to recipients of a high school diploma. The results, which are reported in Table 3 (first column), suggest that high school dropouts with no GED receive significantly lower wages than diploma recipients. This wage differential decreases as the grade level at which the individual dropped out increases. An eighth grade dropout with no GED earns 27 percent less than a diploma recipient, while a twelfth grade dropout with no GED earns 16 percent less than a diploma recipient. Recipients of a GED earn less than diploma recipients but about 13 percent more than dropouts with no GED. An eighth grade dropout with a GED earns only 15 percent less than a diploma recipient as opposed to 27 percent less without a GED. A twelfth grade dropout with a GED earns only 4 percent less than a diploma recipient as opposed to 16 percent less without a GED. Results are statistically significant. This is noteworthy in that it suggests that a GED is beneficial in the labor market. A GED increases one's wages in comparison to those without a GED who dropped out in the same grade level.

It may be the case that the impact of a GED varies with the number of years of education received prior to dropping out. Model 2 allows for the interaction of GED with the highest grade level attained by the recipient. Table 3 (second column) contains the results, which are statistically significant, and still show that high school dropouts with no GED receive significantly lower wages than diploma recipients. These wage differentials are very similar to those of Model 1. An eighth grade dropout with no GED earns 28 percent less than a diploma recipient. A twelfth grade dropout with no GED earns 15 percent less than a diploma recipient. When grade level and GED are interacted, results show that a GED seems to help an eighth grade dropout more than a twelfth grade dropout. An eighth grade dropout with a GED earns 10 percent less than a diploma recipient and a twelfth grade dropout with a GED earns 6 percent less than a diploma recipient. Therefore, an eighth grade dropout increased wages by 18 percent in relation to diploma recipients when a GED is obtained. A twelfth grade dropout increased wages by only 9 percent. This indicates that the effect of GED attainment varies with the grade at which a

dropout leaves school.

These results are quite different from those of Cameron and Heckman (1993)[15]. Whereas Cameron and Heckman found that in 1978, GED recipients had indistinguishable labor market outcomes from dropouts, I found that in recent years, GED recipients do earn higher wages than dropouts in comparison to diploma recipients. Possibly, the increase in human capital or the signaling device that comes from the GED bears more weight in the labor market in more recent years. Also, I use CPS data, include more variables, and include a wider age range. These could all contribute to the different results. It may also be the case that the characteristics of dropouts and GED takers have been changing. Cameron and Heckman began their study relatively soon after the Vietnam War. Perhaps many of the men that fought in the war experienced a disruption in their educational attainment that could have affected both education level and labor force status. In the mid to late 1970s, half of U.S. soldiers had not finished high school, whereas in 2003 only 6 percent of army soldiers lacked a high school graduation credential.[16] My study is more consistent with Tyler, Murnane, and Willett's findings. Although they looked at young white dropouts on the margin of passing the GED exam in 1990, they also found higher wages associated with those who received their GED.

The mechanism through which GED attainment is associated with higher wages remains unclear. The GED could be a signal to employers that an individual is more qualified, motivated, or able to work. Along these lines, GED takers may be more motivated than non-takers. Therefore, the more motivated individuals take the test, which then helps their labor market status. Another explanation is that the GED recipient actually gains more human capital while studying for the test, which makes the individual more productive in the work place. While it is not possible to distinguish between these theories with these data, the results of both models indicate that GED attainment is associated with increased wages. Moreover, the results of Model 2 provide some insight into the distinction between signaling and human capital formation. Results indicate that the GED still helps twelfth grade dropouts in their labor market outcomes. It is possible that a twelfth grade dropout has almost as much (if not the same) level of human capital as high school graduates. Yet, the GED still helps them, indicating that the GED may be seen as a signal to employers. Also, eighth grade dropouts are helped significantly more by the GED

[15] Cameron, Stephen V., and James J. Heckman. "The Nonequivalence of High School Equivalents." Journal of Labor Economics, 11, 1993.

[16] Kaplan, Fred. "The Dumbing-Down of the U.S. Army and Some Modest Proposals for Countering the Trend." Slate Magazine, 2005. <http://www.slate.com/id/2127487/>.

than any other grade level. Eighth grade dropouts never attended high school. Therefore, they may have significantly less human capital than an eleventh or twelfth grade dropout. Perhaps these eighth grade dropouts then benefit more from the signal of the GED. It could also be the case that eighth grade dropouts are more motivated to obtain a GED because they believe it will help them more in the labor market, having dropped out so early.

These estimates of the return to a GED may be biased upward because of the issue of ability. It may be the case that more able dropouts—who also tend to earn higher wages—are the ones who are choosing to take the GED. Heckman and LaFontaine (2006) suggest that estimates of GED returns using CPS data are biased upward because there is no available measure of ability and that Cameron and Heckman's (1993) study is preferable because they use the AFQT test to proxy for ability.[17] However, as often pointed out in the literature, AFQT is not a clear measure of innate ability and likely also reflects learned knowledge and skills.[18] In this case, AFQT scores will be positively correlated with GED attainment not because of innate ability; but because they are another measure of human capital acquisition, and including them in the regression model may lead to underestimation of the effect of the GED. The Cameron and Heckman results may provide a lower bound for the true effect of the GED while these may provide an upper one.

Model 3 tests the effects of GED attainment on labor force participation in relation to diploma recipients. Results, which are shown in Table 4, indicate that dropouts are more likely to be "not in the labor force" (less likely to be in the labor force) than diploma recipients. A ninth grade dropout is 1.7 percentage points less likely to be in the labor force, while a twelfth grade dropout is 0.9 percentage points less likely to be in the labor force than a diploma recipient. However, the results do not indicate an association between GED and participation.

Model 4 tests the effects of GED attainment on employment. Results (displayed in Table 4) show that dropouts are less likely to be employed than diploma recipients. In particular, a ninth grade dropout is 4.6 percentage points less likely to be employed, while a twelfth grade dropout is 1.8 percentage points less likely to be employed. But again, the GED coefficient is statistically insignificant and small, indicating that a GED plays little role in employment.

I next report the results of a series of probits to explain whether the

---

[17] Heckman, James J. and Paul A. LaFontaine. "Bias-Corrected Estimates of GED Returns." Journal of Labor Economics, 24, 2006.

[18] Neal, Derek A., and William R. Johnson. "The Role of Premarket Factors in Black-White Wage Differences." The Journal of Political Economy, 1996.

GED has an effect on the likelihood of working in a particular occupation.[19] From Table 5, it is apparent that dropouts with no GED are more likely to have a farming and labor occupation over diploma recipients. These two occupations are lower-skilled and lower-paying. Furthermore, dropouts with no GED are less likely to have a professional, managerial, and technical, sales, or blue collar occupation over diploma recipients. These occupations are classified as higher-skilled and higher-paying. Results suggest that a GED decreases the probability of one working in these lower-skilled occupations and moves them into higher-skilled occupations. One should note that the causality is not completely certain here. It may be the case that the GED assists individuals with moving into higher-skilled occupation. Alternatively, individuals in higher-skilled occupations may be more likely to take the GED exam because they expect higher returns.

These findings are important in a larger sense in that they indicate that the GED may increase one's wages relative to dropouts as well as increase one's probability of moving into a higher paying occupation. GED attainment appears to be especially important for those individuals who dropped out early in high school. Perhaps states should make it easier for people to take these tests by lowering fees or increasing the number of test centers. If the GED really is becoming increasingly advantageous in labor market outcomes, then more stress should be put on the importance of these tests.

IV. Conclusions

Estimates using CPS data from 1999-2006 suggest that dropouts without a GED earn statistically significantly lower wages than high school diploma recipients. Dropouts who do obtain their GED offset this negative wage differential by an average of 13%. When allowing for effects to vary by highest grade level achieved, results suggest that a GED helps eighth grade dropouts more than it helps twelfth grade dropouts in terms of wages. These findings differ from those of Cameron and Heckman using NLSY data from 1978, where there was no difference in wages of high school dropouts and GED recipients.[20] This suggests that in more recent years, the GED may be more beneficial in its translation into higher wages in the labor market.

In addition, this study finds that dropouts are less likely to be in the labor force and less likely to be employed compared to diploma recipients.

[19] Probit models of industry selection were also done, but results were similar to those of occupation selection.

[20] Cameron, Stephen V., and James J. Heckman. "The Nonequivalence of High School Equivalents." Journal of Labor Economics, 11, 1993.

However, the results suggest that the GED has no effect on either labor force participation or employment but that the GED may increase one's chances of being in a higher-paying occupation.

These results may hint that the GED could be more of a signaling device. However, it is inconclusive whether the GED's effect on the labor market is because of its signaling value or because the test-takers studying for the test are actually acquiring more human capital. Also, the association of a GED with higher wages could be because higher ability individuals are the ones who are seeking a GED. An interesting future study could be one that controls for ability or instruments for GED attainment, perhaps by using some natural experiment that made it easier or cheaper for one group to get the GED. The GED still may not be the high school diploma "equivalent" that it claims to be; but it may be becoming increasingly more equivalent, at least in terms of labor market success.

Table 1: Summary statistics

	Obs.	Mean	Std. Dev	Min.	Max.
wage	182,234	17.71	9.40	2.14	513
age	270,036	44.21	11.17	25	65
north	270,036	0.21	0.41	0	1
south	270,036	0.34	0.47	0	1
west	270,036	0.19	0.40	0	1
central	270,036	0.25	0.44	0	1
white	270,036	0.78	0.41	0	1
black	270,036	0.12	0.33	0	1
other	270,036	0.04	0.18	0	1
hispanic	270,036	0.06	0.24	0	1
married	270,036	0.61	0.49	0	1
children	270,036	0.29	0.45	0	1
grade8	270,036	0.06	0.24	0	1
grade9	270,036	0.04	0.20	0	1
grade10	270,036	0.08	0.27	0	1
grade11	270,036	0.10	0.29	0	1
grade12	270,036	0.04	0.19	0	1
GED	270,036	0.09	0.29	0	1
diploma	270,036	0.69	0.46	0	1

Table 2: Summary statistics:
Mean GED attainment by grade level

	Obs.	Mean	Std. Dev.
If grade 8	16,105	0.11	0.32
If grade 9	11,259	0.24	0.43
If grade 10	20,554	0.32	0.47
If grade 11	25,891	0.38	0.49
If grade 12	10,557	0.34	0.48

Table 3: OLS Model of Log-Wages		
	Model 1	**Model 2**
grade8	-0.271***	-0.280***
	(0.006)	(0.006)
grade9	-0.240***	-0.239***
	(0.006)	(0.007)
grade10	-0.201***	-0.198***
	(0.004)	(0.005)
grade11	-0.181***	-0.185***
	(0.004)	(0.004)
grade12	-0.162***	-0.149***
	(0.006)	(0.007)
GED	0.126***	0.179***
	(0.004)	(0.014)
gedxgrade9		-0.057***
		(0.019)
gedxgrade10		-0.062***
		(0.016)
gedxgrade11		-0.043***
		(0.016)
gedxgrade12		-0.088***
		(0.018)
R-squared	0.190	0.190
n	182,234	182,234

Standard errors in parentheses are robust. *p<0.10 **p<0.05 ***p<0.01. All regressions include controls for age, geographical location, race, marital status, children, occupation, industry, government employment, and years.

Table 4: Model 3 probit of not in labor force and Model 4 probit of employment		
	nilf	**employment**
grade8	0.013***	-0.026***
	(0.002)	(0.003)
grade9	0.017***	-0.046***
	(0.002)	(0.004)
grade10	0.015***	-0.033***
	(0.002)	(0.002)
grade11	0.013***	-0.032***
	(0.002)	(0.002)
grade12	0.009***	-0.018***
	(0.002)	(0.003)
GED	0.000	0.001
	(0.001)	(0.002)
n	215,506	208,646

Standard errors in parentheses are robust. *p<0.10 **p<0.05 ***p<0.01. All regressions include control for age, geographical location, race, marital status, children, occupation, industry, government employment, and years.

Table 5: probit models of occupation selection						
	professional, managerial, technical	**services**	**sales**	**bluecollar**	**farming**	**labor**
grade8	-0.071***	0.047***	-0.046***	-0.035***	0.046***	0.091***
	(0.002)	(0.004)	(0.002)	(0.002)	(0.003)	(0.005)
grade9	-0.068***	0.025***	-0.044***	-0.030***	0.027***	0.121***
	(0.002)	(0.004)	(0.002)	(0.002)	(0.003)	(0.005)
grade10	-0.066***	0.017***	-0.040***	-0.027***	0.018***	0.121***
	(0.002)	(0.003)	(0.001)	(0.002)	(0.002)	(0.004)
grade11	-0.055***	0.014***	-0.034***	-0.026***	0.011***	0.104***
	(0.002)	(0.003)	(0.001)	(0.001)	(0.001)	(0.004)
grade12	-0.037***	0.017***	-0.025***	-0.020***	0.008***	0.064***
	(0.003)	(0.004)	(0.002)	(0.002)	(0.002)	(0.006)
GED	0.053***	-0.003	0.023***	0.027***	-0.011***	-0.055***
	(0.004)	(0.003)	(0.003)	(0.003)	(0.001)	(0.005)
n	208,646	208,646	208,646	208,646	208,646	208,646

Standard errors in parentheses are robust. *p<0.10 **p<0.05 ***p<0.01. All regressions include controls for age, geographical location, race, marital status, children, government employment, and years.

References

Ashenfelter, Orley, and Cecilia Rouse. "Income, Schooling, and Ability: Evidence From a New Sample of Identical Twins." The Quarterly Journal of Economics, 113, 1998.

Boesel, David, Nabeel Alsalam, and Thomas Smith. "Research Synthesis: Educational and Labor Market Performance of GED Recipients." U.S. Department of Education. 1998. < http://www.ed.gov/PDFDocs/GED/gedfront.pdf >.

Cameron, Stephen V., and James J. Heckman. "The Nonequivalence of High School Equivalents." Journal of Labor Economics, 11, 1993.

GED Testing Service, 2004. "Trends in the Number of U.S. GED Candidates Who Tested, Completed, and Passed the GED Tests: 1995-2004." <http://www. acenet.edu/AM/Template.cfm?Section=GEDTS&Template=/CM/ContentDisplay.cfm&ContentID=11865>.

Heckman, James J. and Paul A. LaFontaine. "Bias-Corrected Estimates of GED Returns." Journal of Labor Economics, 24, 2006.

Jaeger, David A., and Marianne E. Page. "Degrees Matter: New Evidence on Sheepskin Effects in the Returns to Education." The Review of Economics and Statistics, 4, 1996.

Kaplan, Fred. "The Dumbing-Down of the U.S. Army and Some Modest Proposals for Countering the Trend." Slate Magazine, 2005. <http://www.slate.com/id/2127487/>.

Neal, Derek A., and William R. Johnson. "The Role of Premarket Factors in Black-White Wage Differences." The Journal of Political Economy, 1996.

Tyler, John H., Richard J. Murnane, and John B. Willett. "Do the Cognitive Skills of School Dropouts Matter in the Labor Market?" The Journal of Human Resources, 35, 2000(a).

Tyler, John H., Richard J. Murnane, and John B. Willett. "Estimating the Labor Market Signaling Value of the GED." The Quarterly Journal of Economics, 115, 2000(b).

Tyler, John H. "The General Educational Development (GED) Credential: History, Current Research, and Directions for Policy and Practice." Review of Adult Learning and Literacy, 2005. URL http://www.ncsall.net/fileadmin/resources/ann_rev/rall_v5_ch3.pdf.

The Effects of Excise Tax on Cigarette Consumption: A Divergence in the Behavior of Youth and Adults

Serginio Sylvain[1]
Massachusetts Institute of Technology

Abstract

There has been a lot of research done to better understand the effects of taxation on cigarette consumption. Since cigarettes are addictive, it could be expected that taxation would have little or no effect on the number of cigarette smoked per day or the percentage of smokers within a given population. This paper aims to investigate these effects and, more specifically, differentiate between adult smokers and underage smokers. It will be shown that the percentage of adult smokers does not change with taxation whereas the percentage of underage smokers decreases significantly when excise taxes on cigarettes increase. In addition, it will also be shown that the average number of cigarettes smoked per day decreases as well.

[1]Serginio Sylvain is a fourth year student the Massachusetts Institute of Technology with a dual concentration in Economics and Mathematics. He is grateful to Professor Sara Ellison and Pablo Querubin for all the guidance and advice they gave him. He is also grateful to Jason Forte and Benjamin Mensah for many conversations as well as their critique. He can be easily reached at **serginio@mit.edu**.

I. Introduction

The effects of cigarette excise taxes on the behavior of smokers have been long debated. State governments, in an effort to reduce cigarette consumption (number of smokers and number of cigarettes smoked) and deter at-risk populations from beginning to smoke, have introduced many increases in taxes on cigarettes. The dire effects of cigarette use on health are well-established facts. According to the 2004 Surgeon General's Report, smoking causes ninety percent of lung cancer cases among men, eighty percent of cases among women, and makes someone twenty times more likely to develop lung cancer than a non-smoker. Smoking causes a plethora of other types of cancers and diseases as well[2]. Thus from a health care perspective, cigarette use should be reduced.

Whether cigarette taxes effectively achieve state governments' goal of reducing cigarette consumption is a key question that needs to be answered to better determine the direction of future policies. Indeed, if the consumption of cigarettes is fairly inelastic, then it cannot be argued that taxation directly reduces consumption. On the other hand, it would imply that cigarette taxation is a good way of raising revenue which can then be used in more effective means of reducing cigarette consumption while deterring potential future smokers from starting to smoke. Conversely, if excise taxes on cigarettes do improve smokers' behavior, then more taxation should take place. It may also be the case that the taxation causes distortionary behaviors among smokers. Since tobacco is addictive, taxation could force smokers to reduce consumption of other goods to maintain the same level of cigarette consumption. It could also be that smokers are rational in their decision to smoke. Reducing the number of cigarettes smoked would only hurt such a smoker. An additional plausible argument is that smokers are not fully rational in their decision because they are not fully aware of all the side-affects of smoking. All of these divergent opinions show that the issue at hand is a complicated one. Nonetheless, knowing the consequences of taxation is the first step towards addressing all of these questions. An analysis of the effects of excise taxes on cigarette consumption is needed to measure how successfully they reduce smoking (if at all).

The population of smokers is not homogenous. When investigating the effects of taxation, one needs to consider different population subgroups separately. One important partition to take into account is that of the adult smokers (those of eighteen years of age or older) and the underage smokers. In this paper, the hypothesis is that underage smokers decrease their consumption

[2] CDC.<http://www.cdc.gov/tobacco/data_statistics/sgr/sgr_2004/00_pdfs/SGR2004_Whatitmeanstoyou.pdf > 15 October 2007.

of cigarettes when faced with an increase in cigarette taxes, while adult smokers do not. Underage smokers have less buying power on average than their adult counterparts so the cigarette taxes affect them more. In addition, adult smokers are more likely to be experienced smokers with many more years of smoking than underage smokers. Thus, smoking is probably a more integral part of the lives of adult smokers than it is for younger smokers. This would imply that cigarette consumption has relatively large tax elasticity for youth smokers but not for adult smokers. The research and analysis that follow will investigate this claim while controlling for key factors such as state tobacco regulations, inflation, the level of spending on anti-tobacco campaigns, and state population characteristics (percentage of different ethnicities, average age, population density, religious makeup, etc.).

II. Literature Review

There exists an extensive amount of literature that has investigated the factors affecting cigarette consumption. Jonathan Gruber and Sendhil Mullainathan (2002) have studied the amount of happiness gained or lost because of cigarette taxation. They use General Social Surveys from the United States and Canada to obtain self-reported data on happiness. They conclude that taxation makes smokers happier because it serves as a self-control device, forcing individuals to smoke less or more likely to quit smoking. This paper, however, omits measuring the direct effect on consumption; in other words, it does not measure how much less people smoke. Philip DeCicca, Donald Kenkel and Alan Mathios (2002) have investigated the effects of cigarette taxation on cigarette consumption from eighth grade to twelfth grade. They use data from the US National Education Longitudinal Survey and find that small increases in taxes do not significantly affect the rates of youth smoking. However, they admit not knowing the effects of larger tax increases. Conversely, Jonathan Gruber (2000) has found that cigarette prices in the 1990's affected consumption among older teens considerably. More recently, Rosemary Avery, Donald Kenkel, Dean R. Lillard, and Alan Mathios (2007) have revealed that smoking cessation advertising significantly affects cigarette consumption by making smokers more likely to attempt to quit. In an experimental paper modeling the cigarette industry as an oligopoly, Wei Tan (2006) has shown that taxation directly decreases cigarette consumption in both the short run and the long run, while restrictions on cigarette marketing can only affect consumption indirectly through their impact on the concentration of the market. Christopher Carpenter and Philip J Cook (2007) have shown that the intensity of youth smoking tends to decrease when taxes are introduced. Their paper focuses mainly on measuring the subsequent changes in the probability of being a

youth smoker and uses solely the Centers for Disease Control and Prevention (CDC) YRBS data.[3]

However, from the above-mentioned research, no definite conjecture can be made about the effects of taxation on the number of smokers or the amount of cigarettes smoked daily. They do not investigate the possible differences in the impact of cigarette taxes on adults and youths either. Indeed, research that focuses on the differential effects of taxation on adult and youth cigarette consumption is scarce. This paper aims to provide such a focused analysis. In addition, the large cigarette tax increases that have taken place in the past fives years provide a great setting to directly study the effects of taxation. Consequently, by using reliable data (from many sources) for up to 2006, the following analysis will further previous research on cigarette taxation by providing updated results on the effects of taxation on cigarette consumption.

This study uses a panel data set that mitigates endogeneity issues that could otherwise arise with taxation and permits us to determine causal relations. It will be shown that increases in excise taxes on cigarettes do not affect the percentage of adult smokers. However, they do cause a decrease in the average number of cigarettes smoked daily by adult smokers and do cause a decrease in the percentage of youth smokers as well. The paper is structured as follows. The next section provides a description of the data set with an emphasis on key variables and the sources used to obtain the data. The penultimate section elaborates on the models used and the results of the analysis. The paper concludes with a discussion of the policy implications of the results and suggested areas for future research.

III. Data

To perform the analysis, a panel data set is used. The data set contains information on forty-nine states plus the District of Columbia (Hawaii and Puerto-Rico are omitted) from 1986 to 2006 for a maximum of 1050 observations. The data on cigarette consumption (percentage of population who smokes, average number of cigarettes smoked per day, tobacco legislation, expenditures on anti-smoking campaigns) come from the CDC[4]. For the panel data regressions, the dependent variables are either ***Smokers_Total*** (annual percentage of total smokers among adults and high school students), ***Smokers_A*** (annual percentage of adult smokers), ***Smokers_Y*** (annual percentage of high

[3] Carpenter, Christopher, and Phillip Cook. "Cigarette Taxes and Youth Smoking: New Evidence from National, State & Local Youth Risk Behavior Surveys." NBER Working Paper No. 13046 (2007).

[4] CDC. <www.cdc.gov > 17 October 2007.

school students who smoke), or ***Cigs*** (average number of cigarettes smoked by an adult smoker daily). Tables 1 and 2 provide a detailed description of all the variables used and their summary statistics.

The data on ***Smokers_A*** comes from the CDC's Behavioral Risk Factor Surveillance System (BRFSS), where they define an adult smoker as anyone of at least eighteen years of age who has smoked at least one hundred cigarettes in the past and currently smokes everyday or on some days. Data is provided for 1986 through 2006. For the first seven years, about twelve states were not included in the BRFSS program. This explains why the number of observations is shy of 1050. The data on ***Smokers_Y*** comes from the CDC Youth Risk Behavior Survey (YRBS). This survey took place every two years from 1993 to 2005 and contains data for about half of the states. It measures the percentage of high school students (grades 9 through 12) who smoke. It may be that the states which chose to participate in this survey are those where underage smoking is more prevalent. It may also be that the high school students who participated in the survey were those who felt more comfortable revealing their smoking habits and also those who smoked the most. These two reasons would explain why there are only one-hundred-and-seventy-six observations. An additional consequence is that if any taxation effect (on ***Smokers_Y***) is measured, then it would likely underestimate the true effect. This would be the case because high school students who smoke the most are the ones who have a stronger habit of smoking and would be expected to have the lowest taxation elasticity in their demand for cigarettes. The ***Smokers_Total*** variable is obtained by calculating the weighted average percentage of smokers (both adult and underage) using ***Smokers_A*** and ***Smokers_Y***. The data on ***Cigs*** comes from the BRFSS as well. The BRFSS reports the average daily consumption of cigarettes by adult smokers in 1992 and from 1994 through 2000. The ***Tax*** variable as well as the one-year and two-year lagged tax variables (***Lag1_Tax***, ***Lag2_Tax***) are obtained from the CDC as well.

The CDC provides the total annual funding (federal, state and outside funding) for anti-tobacco campaigning for 2001 and 2002 only. For 2003 through 2006, the CDC provides information on federal funding and outside funding but excludes state funding. To complete the data for 2003 through 2006 the state funding for anti-smoking expenditures is obtained from Campaign for Tobacco-Free Kids[5] and added to the data acquired from the CDC[6]. For the years preceding 2001, no data is available on these expenditures. The U.S. Department of Commerce Bureau of Economic Analysis provides data on state real GDPs (used to calculate ***Log_GDP***) and the Bureau of Labor and

[5] Campaign for Tobacco-Free Kids. <www.tobaccofreekids.org> 17 October 2007.
[6] Campaign for Tobacco-Free Kids, Ibid.

Statistics provides the data on state CPIs (***CPI***). Interaction variables between ***Log_GDP*** and ***CPI*** and the ethnicity variables (***Black***, ***Hispanic***, and ***White***) are used to measure how combined changes in average state income (or prices) and the percentage of people of each respective ethnicity could together affect cigarette consumption.

The United States Census Bureau provides annual data on state demographics (population, area, education levels, ethnicities, etc.) which may influence cigarette consumption. States' characteristics are included in the data set. Due to a law passed in 1976, the US Census Bureau is prohibited from asking questions about religious affiliation in its surveys[7]. To obtain data on the religious affiliation in each state, the American Religious Identification Survey (ARIS 2001)[8] is used. ARIS 2001 was a study conducted by Egon Mayer, Barry A. Kosmin, and Ariela Keysar at the City University of New York in 2001. More than fifty thousand households in the continental United States were telephoned randomly and asked about their religious affiliation. The results of that survey give a good approximation of the religious classifications in each state. ARIS 2001 provides the percentage of the population that belongs to each of twenty-two religions for each respective state. Since the goal of using data on religion in the data set is to control for possible effects of religion membership on cigarette consumption, two dummy variables for the most popular religions are introduced. The ***Catholic*** dummy equals one if more than thirty-five percent of the population in a given state is Catholic. The ***Baptist*** dummy plays a similar role[9].

In addition to the anti-smoking campaigning and religious prevalence, cigarette legislation may affect cigarette consumption as well. Indeed, in many states it is no longer legal to smoke in bars, inside restaurant, on public property, etc. This warrants the use of a control variable. The variable ***Regulations*** measures the level of restrictions on cigarette use in each state. This variable is built using eleven different measures of restrictions on cigarette use provided by the CDC. These are: the maximum penalties for violating laws against smoking on government worksites, on private worksites, and inside restaurants, and the type of restrictions on smoking (complete or partial ban of cigarette smoking) in bars, enclosed arenas, grocery stores, hospitals, hotels, malls, prisons, and public transportation. Since the maximum penalty for violation is a fine of $2000, a value of 2000 is assigned to any maximum fine of

[7] US Census Bureau. <http://www.census.gov/prod/www/religion.htm> 17 October 2007.

[8] Central University of New York. <http://www.gc.cuny.edu/faculty/research_briefs/aris/aris_index.htm> 17 October 2007.

[9] Table 1 lists and describes all the variables contained in the data set

that amount for any given year in any given state. All other instances where a state sets a maximum penalty below $2000 are assigned a value equal to the maximum penalty itself. The cases where cigarette use is completely banned are given a value of 2000 as well. A value of 500 is assigned to the cases where smoking is allowed in designated areas of the workplace, and a value of 800 is assigned to the cases where smoking is only allowed in separate ventilated areas. The cases where there are no bans on cigarette use are given the value zero. The variable ***Regulations*** is then calculated for any given state and any given year as the sum of the values of the eleven corresponding measures of cigarette use restrictions divided by 11 x 2000 (since there are eleven measures, and the maximum value for each is 2000). Thus, this variable provides a good measure of the severity of the cigarette regulations in any state in any year from 1995 to 2006. The more stringent these regulations are, the higher the value of ***Regulations*** is.

It could be argued that as legislation regulating cigarette use intensifies, the number of cigarettes purchased through the black market increases. Indeed, Patrick Fleenor (2003), former senior economist with the Joint Economic Committee of the United States Congress, argues that increases in taxes on cigarettes (now up to three dollars per pack) in New York have caused a great increase in black market activities. If this is true, then the effects on cigarette consumption that would be measured through the model would not be accurate because part of the reduction in consumption from any increase in taxes would be mitigated by an increase in the consumption of cigarettes from the black market. Possible factors that may contribute to the rise in black market activities include state size and population, which are controlled for here in this paper. An additional set of dummies is included in the data set to help control for the black market supply of cigarettes. These variables equal one if a given state shares a border with Canada, Mexico, the Pacific Ocean, or the Atlantic Ocean respectively. Since part of the black market supply of cigarettes comes from neighboring countries and other contrabands, these variables at least partly control for these black market activities.

Controlling for black market activities is difficult since black markets are not easily observed. This causes a flaw in the data set. Indeed, part of the black market supply of cigarettes comes from the internet. Cigarettes can be purchased from parties all over the world without paying taxes, while bypassing the laws on minimum age for cigarette smoking. There exists no reliable measure of the volume of cigarettes purchased via the internet and the data set does not have any variable that attempts to control for it.

One additional flaw in the data set lies in fact that the religion data in ARIS 2001 are provided for 2001 only. In the data set, however, the same

figures from ARIS 2001 are used for all the years from 1986 through 2006. Thus, the assumption is that the religious composition of state populations has not changed much during these twenty-one years. Though this assumption may hold, there is still a possibility that it is not fully justified. These flaws are minimal, however, and the data set still provides a good foundation for an accurate analysis. Since the number of observations are fairly large (Table 2), some causal relationships will be determined in the following sections.

IV. Methods and Results

In order to determine how taxation affects cigarette consumption for both adult smokers and underage smokers, we need to observe how changes in tax rates affect the percentage of adult and underage smokers as well as the number of cigarettes smoked over time. Using the panel data set described above, four appropriate sets of regressions can be run; these regressions have ***Smokers_Total***, ***Smokers_A***, ***Smokers_Y***, and ***Cigs*** as the respective endogenous variables. The following specifications are used:

$$Smokers_{i,t} = \beta_1 Tax_{i,t} + \beta_2 Log(GDP)_{i,t} + \beta_3 CPI_{i,t} + \Theta Z + \mu_i + \epsilon_{i,t}$$
$$Cigs_{i,t} = \gamma_1 Tax_{i,t} + \Gamma Z + \eta_i + \nu_{i,t}$$

Table 3 and Table 4 use the first model where the left-hand side variable is respectively ***Smokers_A*** or ***Smokers_Y***. Table 5 uses the second model. It is important to notice that in each regression only one tax variable is used (***Tax***, ***Lag1_Tax***, or ***Lag2_Tax***). This helps to better isolate any possible tax effects. In both models, state fixed effects are used. This is done to control for unobserved heterogeneity between the states. Fixed effect models are used rather than between or random effects models because it is unlikely that the states (which are governed by the same federal government) have policies that are the same across states but evolve differently with time. The model warrants year dummies as well. In all the regressions a dummy for each year (***Yr_t***) is included to help avoid associating general time trends in cigarette consumption with the effect of taxes or other explanatory variables. Indeed, more is known about the health side-effects of cigarettes today than ever before. Furthermore, more awareness programs and anti-smoking campaigns take place than ever before, so it is likely that the general trend in cigarette smoking in the United States of America (and also the rest of the world) is a downward one. To avoid associating this trend effect with the effects of increases in taxes, twenty-one year dummies (***Yr_1986*** to ***Yr_2006***) are used; one is used for each of the twenty-one years of data in the panel data set. ***Z*** is a vector of explanatory variables which contains ***Yr_t*** as well many other key control variables.

The results for the regressions of ***Smokers_Total*** (not shown in this

paper) have a lot of spurious results. One of the reasons why this occurs is that in building such a variable, the underlying assumption is that the percentage of adults and the percentage of people of high school age (14 to 17 years old) within any state do not vary with time. This assumption may not hold and is most likely one of the main sources of the spurious results. However, using separate regressions for adult smokers and underage smokers yield the correct results. Table 3 shows the results for the regressions of ***Smokers_A***. The first three regressions in this table contain all of the explanatory variables with the exception of ***Population***, ***Density***, ***Regulations***, ***Educ***, ***Log_Funding***, ***Black***, ***White***, ***Hispanic***, and the respective interactions between ***CPI*** and ***Log_GDP*** with the ethnicity variables. For the regressions in columns four through six, ***Black***, ***White***, and ***Hispanic*** variables are added, as well as the respective interactions with ***CPI*** and ***Log_GDP***. The regressions in columns seven through nine contain all of the explanatory variables. Table 3 contains similar regressions for ***Smokers_Y*** but a few year dummies were dropped in these regressions because of insufficient observations. Table 4 contains the regression results for ***Cigs***. ***Educ*** is not included in any of the ***Smokers_Y*** (and ***Smokers_Total***) regressions because of insufficient observations, just as ***Log_Funding*** and ***Educ*** are not included in any of the ***Cigs*** regressions.

The regressions for ***Smokers_A*** (Table 3) reveal that taxes do not significantly affect the percentage of adult smokers within a state's population. Indeed, the coefficient on ***Tax*** (-.038) in Column 1 decreases in magnitude and loses its significance as more explanatory variables are included. The same effect can be noticed for the two-year and the one-year lagged tax variables. In columns one through six, the signs of the coefficients on ***Tax***, ***Lag1_Tax***, and ***Lag2_Tax*** are negative as should be expected since an increase in taxation on cigarettes is aimed at decreasing cigarette consumption and encouraging smokers to quit smoking. However, in the regressions with a full set of explanatory variables (Column 7 to Column 9), these coefficients lose their sign and become completely insignificant. This indicates that adult smokers were on average unaffected by excise tax increases. This may be due to the fact that cigarette costs (even with the tax increases) are relatively low when compared to adult smokers' incomes. Indeed, this would explain this hesitance towards quitting smoking despite increases in taxation. The more important reason, however, may just be the fact that smoking cigarettes is addictive. Adult smokers are most likely experienced smokers who have developed a strong habit of smoking. The increases in the cost of cigarettes due to the taxation are not enough to warrant abandoning a habit which has taken many years to develop.

It is also interesting to notice that ***Density*** and ***GDP_Hispanic*** become

significant when we include all the explanatory variables (Column 7 to Column 9). The positive coefficient on ***GDP_Hispanic*** has a 10% p-value. This may reflect the fact that smoking is more prevalent or socially acceptable among Hispanic adults. Increases in average state income (as reflected through an increase in GDP) augment the amount of disposable income available and may encourage those who were already thinking about smoking to do so. However, to fully measure the effect of ***Hispanic*** on cigarette consumption, the coefficient of ***Hispanic*** as well as the coefficients of all interaction variables that include ***Hispanic*** should be added. Since most of these variables are insignificant, the net effect of ***Hispanic*** is most likely insignificant as well. The negative coefficient on ***Density*** suggests that when population density within a state increases by one unit, the average number of adult smokers becomes .03% less of the total state population. Such a strong effect may just reflect the fact that in dense populations, second hand smoke is more of a problem. Therefore, the government, the non-smokers, and even the smokers themselves would most likely put some strict restrictions on the freedom to smoke. It may also result from the fact that in states with high population densities, information about the side-effects of smoking and any reduction in the popularity of cigarette smoking propagate more quickly. In Columns 1 through 3, ***CPI*** is negatively related to ***Smokers_A*** and is significant with a one percent p-value. However, including the variables for ethnicities (Column 4 to Column 6) causes the coefficient on ***CPI*** to lose its significance. Including ***Regulations***, ***Log_Funding***, and ***Educ*** (in the regressions in columns seven through nine) causes the ***White***, and ***Log_GDP*** variables to lose their significance. The positive coefficient on ***Yr_1991*** (Column 4 to Column 6) is significant with at 10% p-value. This variable is dropped when we include all of the explanatory variables in columns seven through nine because of insufficient data. However it most likely would have lost its significance since it was barely significant at a 10% level.

The behavior of underage smokers, however, is much different. First, Column 1 to Column 3 of Table 4 shows that ***Tax***, ***Lag1_Tax***, and ***Lag2_Tax*** have no significance. However, in the regressions of ***Smokers_Y*** on a full set of explanatory variables, ***Lag1_Tax*** becomes significant. Indeed, in the regression in Column 6, ***Lag1_Tax*** has a coefficient of -.264 and it is significant with a p-value of 10%. Thus, when taxes are one more percent of the cost of a pack of cigarettes, the average percentage of underage smokers in a state's popula-

tion decreases by .264 percentage points[10]. This negative relation between the one-year-lagged tax and the percentage of young smokers suggests that taxes on cigarettes push underage smokers to quit. This effect, which was absent in the regressions for adult smokers, is most likely a result of the lower buying power of the youth. This renders the average underage smoker more price sensitive than an adult smoker is. It may also be an indication of the fact that underage smokers have less years of experience as smokers than their adult counterparts do. As a result, they are much more likely to abandon their smoking habit when they face an increase in price due to taxation.

In addition, as previously seen in the regressions of ***Smokers_A***, ***GDP_Hispanic*** (Column 4 to Column 9) is significant at a 10% level. However, here the coefficient is negative. Furthermore, ***Hispanic*** becomes significant and has a positive coefficient (3.1 with a p-value between 5% and 10%). The fact that ***GDP_Hispanic*** and ***Hispanic*** have opposite signs is more evidence of the price sensitivity and the relatively low level of addiction to cigarettes among youths. A combined increase in state income and Hispanic population leads to a decrease in the percentage of underage smokers. Increased income may, therefore, lead to less smoking prevalence as the youth (more particularly among Hispanic populations) substitute other more attractive goods for cigarettes. Conversely, a one unit increase in the percentage of Hispanics in a state leads to a 3.1 increase in the percentage of underage smokers. This may be due to a prevalence of cigarette consumption among Hispanics, but that alone does not explain why the corresponding increase in the underage smoker percentage is greater than one. It may also be that an increase in the percentage of Hispanics leads to an atmosphere where smoking is encouraged, perhaps due to ease of access to cigarettes, social acceptance, or peer pressure. However, to fully capture the effect of the ***Hispanic*** variable, the coefficient on ***Hispanic***, ***CPI_Hispanic***, ***GDP_Hispanic*** should be added. Since all of these coefficients do not have the same sign and are not all significant, the net effect may be ambiguous. Nonetheless, a separate investigation would be needed to better understand the possible effects of different ethnic populations

[10] The number of observations for the ***Smokers_Y*** variable may be a source of concern (see Table 2). However, increasing the number of observations by using the average of the previous year's value and the following year's value of ***Smokers_Y*** for every year (from 1995 to 2005) where the YRBS annual survey was not done (which increases the number of observations for ***Smokers_Y*** to 361), then running the regressions while controlling for random effects and including the ***Educ*** and ***Log_Funding*** variables yields a coefficient of -.2305 on the ***Lag1_Tax*** variable. This value is close to the -.264 value obtained in the results included in this paper.

on smoking prevalence.

On the other hand, the ***Yr_1995*** dummy remains significant at a 5% level (Column 1 through Column 6). Its positive coefficient indicates an upward trend in cigarette consumption among youths. This is most likely a direct result of the record spending of tobacco companies on advertising. According to the Federal Trade Commission, tobacco industry spending on advertising accelerated more than ever before in 1995. In addition, in 1995, the spending on promotional allowances (e.g. payments made to retailers to facilitate sales of tobacco products), which represents close to forty percent of advertising expenses, was close to twice its previous level.[11] However, the ***Yr_1997***, ***Yr_1999***, ***Yr_2003*** and ***Yr_2005*** dummies are highly significant as well but have negative coefficients. This may be reflecting a general downward trend in the percentage of underage smokers for these respective years. This is perhaps due to the fact that more youth smokers were quitting in light of all the information about the health effects of cigarettes that were made available with the advent of widely publicized court cases involving tobacco companies. It may also be due to the large increase in anti-tobacco advertising (especially the television advertisements such as those by TRUTH)[12].

A similar effect can be seen for the average number of cigarettes consumed daily by adult smokers (Table 5). The regressions for ***Cigs*** indicate that there was a downward trend in the consumption of cigarettes from 1994 to 2001. This is most likely due to the aforementioned increase in information about the negative effects of tobacco. It is also important to notice that the Master Settlement Agreement,[13] which banned and greatly restricted many forms of advertisements,[14] was put into place in November 1998. Although some of the clauses concerning tobacco advertisements did not go into effect until 1999,[15] the ensuing decrease or ban of many types of advertisement further explains the drop in consumption of cigarettes. Furthermore, the coefficient on ***GDP_White*** is positive (Column 7 to Column 9) and remains significant at a

---

[11] Federal Trade Commission. <http://www.ftc.gov/os/2002/05/2002cigrpt.pdf> 20 October 2007.

[12] TRUTH. <http://www.whudafxup.com/?ref=http://www.google.com/search?sourceid=navclient&aq=t&ie=UTF-8&rls=HPIC,HPIC:2006-35,HPIC:en&q=TRUTH> 20 October 2007.

[13] Northeastern University. <http://tobacco.neu.edu/tobacco_control/resources/msa/index.html#Chapter%20Six> 21 October 2007.

[14] University of Dayton, Ohio. <http://academic.udayton.edu/health/syllabi/tobacco/summary.htm#Marketing> 21 October 2007.

[15] Northeastern University. <http://tobacco.neu.edu/tobacco_control/resources/msa/index.html> 22 October 2007.

10% p-value. This could indicate that White smokers tend to smoke a bit more when the average state income increases. The coefficient on ***White,*** however, is negative and equals -.901 on average (p-value is 10%). A one unit increase in the percentage of Whites in a state population would therefore lead to a .901 decrease in the average number of cigarettes smoked per day. This may be due to a decrease in the prevalence of cigarette consumption among White populations. The net marginal effect of ***White*** is approximately -.830[16] which is still fairly close to -.901. Again, a separate investigation would be needed to fully understand the differential effects of ethinicities on cigarette consumption.

The most important result to underline is in columns two, five, and eight. In these three regressions, the average number of cigarettes smoked by adult smokers decreases with taxes. The coefficient on ***Lag1_Tax*** remains significant (5% p-value) in these three regressions for ***Cigs***. This indicates that an increase in the taxes does cause a decrease in the average number of cigarettes consumed daily by adult smokers; however, it does take some time before the smokers adjust their consumption. From the results discussed above, it is shown that the percentage of adult smokers is unaffected by the taxation. Thus, cigarette taxation has an effect on the intensiveness of consumption rather than its extensiveness. More precisely, if the total state and federal taxes on cigarettes is one more percent of the retail cost of a pack of cigarettes, adult smokers adjust their consumption by smoking .06 cigarettes less per day on average. In other words, if taxes increase by fifteen percentage points, adult smokers consume one less cigarette per day on average.

At the beginning of the paper, the hypothesis was that taxation had no effect on the percentage of adult smokers. This is confirmed by the results (Table 3) which show that ***Smokers_A*** does not vary with current or past taxes. It was also posited that underage smokers are more sensitive to taxation and that the percentage of underage smokers decreases with taxation. This claim is confirmed by the results as well (Table 4). The final claim made at the beginning of the paper was that although the percentage of adult smokers did not vary with taxes, the average number of cigarettes they consumed did. The results in Table 5 support this claim. Indeed adult smokers seem to decrease their consumption on average within a year after an increase in excise taxes. The severe restrictions imposed on tobacco advertising as well as the increase in dissemination of anti-tobacco information from 1997 to 2000 are reflected in the models as well. Indeed, there seems to be a negative trend in the percentage of underage smokers as well as the number of cigarettes smoked from 1997 through 2000. This is most likely a result of the ban on youth-targeted

[16] This value is obtained by adding the coefficients on ***White***, ***CPI_White***, and ***GDP_White***.

tobacco advertising (e.g. the use of cartoon characters like Joe Camel[17]) and widespread and readily available information about the severe side-effects of cigarette smoking. Using random effects models (not shown in this paper) instead of fixed effects models does not affect the results much.

V. Discussion and Conclusions

Identifying the effects of increases in excise taxes on cigarette consumption is essential for determining future governmental policies on tobacco use. As already discussed, the severe health side-effects of cigarettes and their addiction may justify taxation. On the other hand, low taxation elasticity could justify increases in taxes to raise revenues. In this paper, separate longitudinal regressions are used for adult smokers, underage smokers and the average number of cigarettes consumed by adult smokers daily. In addition, the models used control for many key variables such as each state's average real GDP per capita and average CPI for each year from 1986 to 2006, as well as fixed effects to measure time-invariant differences within states. With these models, the aforementioned effect of taxation on cigarette consumption was determined.

The first set of regressions (Table 3) show that taxes have no significant effect on the percentage of adult smokers in a state population. This occurs because adult smokers are most likely experienced smokers who have smoked for many years and who consequently have low price elasticity in their demand for cigarettes. This is reinforced by the fact the cigarette taxes most likely represent a relatively small portion of the adult smokers' wealth. For underage smokers, however (Table 4), cigarette taxes do curb behavior. In particular, the one-year lagged tax is shown to be a significant determinant of the percentage of underage smokers. When taxes represent one more percent of the retail price of a pack of cigarettes, the average percentage of underage smokers within a state decreases by .264 percentage points. Though this value may seem small, it becomes more important when one thinks about the total number of underage smokers in the US. This number is approximately four million,[18] and it decreases by fifty-two-thousand-and-eight-hundred when cigarette taxes in every state increase by one percent. When we consider the dire effects smoking would have on an individual who began to smoke at a young age, this reduction in the number of youth smokers becomes even more important. This decrease in the percentage of underage smokers is due to the

[17] Jim's Burnt Offerings. <http://www.wclynx.com/burntofferings/adsjoecamel.html> 1 November 2007.

[18] This value is obtained by using 20% as the average percentage of smokers among individuals of high school age (14 -17 years of age)

low buying power of the youth, their relatively low level of addiction compared to adult smokers and their large price elasticity of demand for cigarettes. Furthermore, the results show that an adult smoker consumes one less cigarette per day when taxes on the retail cost of a pack of cigarettes increases by sixteen to seventeen percentage points (Table 5). This is not negligible. In fact, According to the British Medical Journal smoking, one cigarette decreases one's expected life by eleven minutes[19]. This reduction in the number of cigarettes consumed would be observed for underage smokers as well (although it is not investigated in this paper). In fact, with the underage smoker's high sensitivity to taxation, it is likely that the reduction in cigarettes consumed would be larger. From these results, important knowledge can be gained for future policies on tobacco.

The state taxation policies on tobacco may have two purposes. The first is to raise funds (for campaigning against tobacco use, and many other state expenses). According to the results discussed above, in the short run, the percentage of adult smokers does not decrease when taxes increase, ceteris paribus. The amount of tax revenue collected from adult smokers, therefore, increases. Although adult smokers reduce the number of cigarettes consumed slightly, this is not significant enough to offset the increase in tax revenues. Similarly, the drop in underage smokers (high school students who smoke) is not large enough to offset the gains in tax revenues because the total number of high school student in any given state is much smaller than the total number of adults[20]. In the long run, however, the total number of smokers could decrease substantially if taxes are increased because fewer youths would begin to smoke in high school, which in turn would lead to a much larger decrease in the number of adult smokers. So, in the long run, an increase in the tax rate could lead to a decrease in the total tax revenue collected.

On the other hand, state government could use cigarette taxation to protect the people's welfare. As Gruber and Mullainathan (2002) have shown, taxation serves as a valuable self-control device for adult smokers, the majority of which would like to quit. At the same time, they have provided evidence showing that individuals consuming addictive substances such as cigarettes may not be fully rational in their decision to smoke and that taxation conse-

---

[19] American Cancer Society. <http://www.cancer.org/downloads/COM/OH2006GASTipSheet.pdf> 2 November 2007.

[20] There are approximately 226 million adults (18 years old and older) in the US and approximately 18 million individual of high school age (14 to 17 years old) according to a US Census Bureau 2007 report: US Census Bureau**. <**http://www.census.gov/popest/states/asrh/tables/SC-EST2006-01.xls> cited 3 November 2007.

quently improves welfare. Thus, it is more likely that younger smokers are not fully taking into account the future side-effects of smoking. In this case, raising taxes would help achieve the goal of raising welfare both in the short run and long run. Indeed, adults and youths would decrease the number of cigarettes they smoke, which prolongs their lives. Furthermore, the number of underage smokers would decrease, and consequently further increase total welfare. Though there may be some distortions in consumption because of taxation, the net increase in future welfare (when we include the future health benefits from not smoking) would surpass these effects. Thus from a welfare perspective, increases in excise taxes on cigarettes should occur.

Nonetheless, to fully understand the effects of taxation of cigarettes, further research is needed. More specifically, future research is highly recommended to uncover the distortions in consumption resulting from cigarette taxation. In addition, further research should be done to investigate how adult smokers with different income ranges respond to increases in excise taxes on cigarettes. More focused research should also take place to formally measure the taxation elasticity of underage smokers. Lastly, to complete the investigation on cigarette consumption, it is necessary to study the ensuing health benefits from increases in taxes on cigarettes as well as the marginal rate of substitution of health for cigarettes.

Table 1: Definition of Variables

Variable	Index Varies Over	Definition
Smokers_Total	i,t	Percentage of smokers (both adult and underage)
Smokers_Y	i,t	Percentage of smokers under the age of 18
Smokers_A	i,t	Percentage of adult smokers
Cigs	i,t	Average number of cigarettes smoked by an adult smoker per day
Tax	i,t	Federal and State tax as percentage of retail price
Lag1_tax	i,t	One-year lagged Federal and State tax as percentage of retail price
Lag2_tax	i,t	Two-year lagged Federal and State tax as percentage of retail price
Black	i,t	Percentage of population that is Black
White	i,t	Percentage of population that is White
Hispanic	i,t	Percentage of population that is Hispanic
Region	i	Federal region (Region 1 through Region 10) to which each state belongs
Catholic	i	Dummy equaling one if the percentage Catholics is greater than or equal to 35
Baptist	i	Dummy equaling one if the percentage Baptists is greater than or equal to 35
Regulations	i,t	Variable reflecting the level of regulations on cigarette use
Canada	i	Dummy equaling one if the state shares a border with Canada
Mexico	i	Dummy equaling one if the state shares a border with Mexico
Pacific	i	Dummy equaling one if the state shares a border with the Pacific Ocean
Atlantic	i	Dummy equaling one if the state shares a border with the Atlantic Ocean
Population	i,t	State population
Area	i	State area
Density	i,t	State population density
CPI	i,t	CPI - Urban Wage Earners and Clerical Workers (Current Series) seasonally adjusted
CPI_Black	i,t	Interaction variable (CPI x Black)
CPI_White	i,t	Interaction variable (CPI x White)
CPI_Hispanic	i,t	Interaction variable (CPI x Hispanic)
Log_Funding	i,t	Natural logarithm of total funding per capita spent on anti-smoking campaigns
Educ	i,t	Percentage of population 25 years or older who have completed high school
Age	i,t	Average age of population in each state
Yr_t	t	Dummy for each year (e.g. Yr_1986=1 if Year=1986; otherwise Yr_1986=0)
Log_GDP	i,t	Natural logarithm of state real GDP per capita
GDP_Black	i,t	Interaction variable (Log_GDP x Black)
GDP_White	i,t	Interaction variable (Log_GDP x White)
GDP_Hispanic	i,t	Interaction variable (Log_GDP x Hispanic)

Notes: i is the state indicator; t is the year indicator.

Table 2: Descriptive Statistics

Variable	Obs.	Mean	Std. Dev.	Min.	Max
Smokers_Total	176	23.397	3.631	11.018	32.706
Smokers_Y	176	27.88	8.27	7.3	47
Smokers_A	968	23.24	3.27	9.8	34.7
Cigs	347	19.18	1.50	12	23.9
Tax	1050	27.31	6.88	10.48	52.27
Lag1_tax	1000	27.13	6.72	10.48	52.27
Lag2_tax	950	26.92	6.52	10.48	52.27
Black	722	24.59	5.16	11	43.9
White	915	23.19	3.40	10.1	33.6
Hispanic	815	23.11	5.87	9.8	50.2
Region	50	5.26	2.71	1	10
Catholic	50	0.16	0.37	0	1
Baptist	50	0.18	0.38	0	1
Regulations	600	0.16	0.14	0	0.75
Canada	50	0.22	0.41	0	1
Mexico	50	0.08	0.27	0	1
Pacific	50	0.06	0.24	0	1
Atlantic	50	0.34	0.47	0	1
Population	850	5444.51	6000.40	453.4	36457.55
Area	50	75663.04	96297.08	68.34	663267.30
Density	850	311.63	1145.13	0.83	8835.44
CPI	950	157.623	22.149	118.193	195.653
CPI_Black	463	3746.723	1140.693	1323.090	8336.840
CPI_White	512	3482.868	733.393	1467.690	5943.695
CPI_Hispanic	815	23.112	5.871	9.800	50.200
Log_Funding	300	15.838	1.131	13.278	19.281
Educ	250	85.02	3.86	75	91.4
Age	1050	34.47	2.40	25.70	41.10
Yr_t	1050	1996	6.06	1986	2006
Log_GDP	850	10.304	0.497	6.537	13.767
GDP_Black	625	247.827	51.536	109.853	453.262
GDP_White	783	234.747	33.746	104.505	333.761
GDP_Hispanic	726	237.761	60.530	101.226	515.006

Notes: the unit of observation is a state-year combination. 1050 observations correspond to the maximum number of observations for fifty states over twenty-one years. The observations less that 1050 occur because of unavailable data for certain years or states.

Table 3: Regressions of the percentage of adult smokers

	Smokers_A								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Tax	-0.038***	--	--	-0.020*	--	--	0.002	--	--
	(0.015)	--	--	(0.013)	--	--	(0.037)	--	--
Lag1_Tax	--	-0.017	--	--	-0.002*	--	--	0.007	--
	--	(0.016)	--	--	(0.013)	--	--	(0.036)	--
Lag2_Tax	--	--	-0.033**	--	--	-0.013	--	--	-0.020
	--	--	(0.016)	--	--	(0.014)	--	--	(0.035)
Black	--	--	--	-0.047	-0.038	-0.035	-0.678	-0.695	-0.724
	--	--	--	(0.183)	(0.183)	(0.183)	(1.926)	(1.925)	(1.919)
White	--	--	--	0.263	0.203	0.248	4.653	4.671	5.044
	--	--	--	(0.402)	(0.403)	(0.404)	(5.689)	(5.679)	(5.706)
Hispanic	--	--	--	-0.288	-0.303	-0.298	-2.660	-2.682	-2.734
	--	--	--	(0.222)	(0.223)	(0.222)	(1.798)	(1.746)	1.745
Regulations	--	--	--	--	--	--	0.682	0.723	0.739
	--	--	--	--	--	--	(1.682)	(1.697)	(1.680)
Population	--	--	--	0.000	0.000	0.000	0.000	0.000	0.000
	--	--	--	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)
Density	--	--	--	0.003**	0.003**	0.003**	-0.030**	-0.030**	-0.030**
	--	--	--	(0.001)	(0.001)	(0.001)	(0.015)	(0.014)	(0.014)
CPI	-0.038***	-0.036***	-0.037***	-0.020	-0.020	-0.019	0.005	0.007	-0.003
	(0.011)	(0.011)	(0.011)	(0.020)	(0.020)	(0.020)	(0.090)	(0.088)	(0.088)
CPI_Black	--	--	--	0.000	0.000	0.000	0.000	0.000	0.000
	--	--	--	(0.000)	(0.000)	(0.000)	(0.002)	(0.002)	(0.002)
CPI_White	--	--	--	0.001	0.001	0.001	0.004	0.004	0.005
	--	--	--	(0.001)	(0.001)	(0.001)	(0.004)	(0.004)	(0.004)
CPI_Hispanic	--	--	--	0.000	0.000	0.000	-0.002	-0.002	-0.002
	--	--	--	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)
Log_GDP	-0.003	0.001	0.000	-1.758**	-1.875**	-1.786*	-1.980	-2.252	-1.412
	(0.142)	(0.143)	(0.143)	(0.964)	(0.969)	(0.970)	(11.390)	(11.444)	(11.394)
GDP_Black	--	--	--	0.011	0.010	0.010	0.063	0.066	0.069
	--	--	--	(0.018)	(0.018)	(0.018)	(0.202)	(0.202)	(0.201)
GDP_White	--	--	--	0.037	0.042	0.038	-0.439	-0.439	-0.481
	--	--	--	(0.038)	(0.038)	(0.038)	(0.538)	(0.537)	(0.541)
GDP_Hispanic	--	--	--	0.027	0.029	0.028	0.287	0.289*	0.294*
	--	--	--	(0.021)	(0.021)	(0.021)	(0.178)	(0.173)	(0.173)
Log_Funding	--	--	--	--	--	--	-0.196	-0.204	-0.185
	--	--	--	--	--	--	(0.174)	(0.179)	(0.175)
Educ	--	--	--	--	--	--	0.099	0.091	0.107
	--	--	--	--	--	--	(0.193)	(0.195)	(0.192)
Age	0.043	0.007	0.031	-0.172	-0.180	-0.162	1.168	1.114	1.407
	(0.126)	(0.127)	(0.126)	(0.144)	(0.145)	(0.145)	(2.114)	(2.083)	(2.071)
Yr_1991	0.040	0.038	0.035	0.084*	0.082*	0.081*	--	--	--
	(0.056)	(0.056)	(0.056)	(0.049)	(0.049)	(0.049)	--	--	--
Yr_2005	-0.053	-0.062*	-0.063*	0.053	0.041	0.043	-0.101	-0.101	-0.100
	(0.039)	(0.039)	(0.039)	(0.045)	(0.045)	(0.045)	(0.091)	(0.091)	(0.090)
Yr_2006	-0.0784**	-0.084**	-0.086**	--	--	--	--	--	--
	(0.039)	(0.040)	(0.039)	--	--	--	--	--	--
Observations	473	473	473	384	384	384	112	112	112
R^2	0.5386	0.5327	0.5360	0.7227	0.7206	0.7213	0.7386	0.7387	0.7399

The time trend variables that are not shown are not significant or lose their significance as more explanatory variables are used. Those that were not included in some regressions are those for which there is no observation for the corresponding year. All other variables from Table 1 and Table 2 which are not included in Table 3 were absorbed by the fixed effect variable. Standard deviations are in parenthesis. Coefficients significantly different from zero in a two-tailed t-test at the *ten percent level; **five percent level; ***one percent level are reported.

Table 4: Regressions of the percentage of underage smokers

	Smokers_Y								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Tax	-0.042	--	--	-0.061	--	--	-0.142	--	--
	(0.083)	--	--	(0.124)	--	--	(0.139)	--	--
Lag1_Tax	--	-0.146	--	--	-0.167	--	--	-0.264*	--
	--	(0.092)	--	--	(0.126)	--	--	(0.138)	--
Lag2_Tax	--	--	-0.028	--	--	0.154	--	--	0.107
	--	--	(0.094)	--	--	(0.153)	--	--	(0.196)
Black	--	--	--	-1.633	-2.084	-1.326	-2.171	-2.692	-1.502
	--	--	--	(2.513)	(2.467)	(2.477)	(2.726)	(2.598)	(2.894)
White	--	--	--	-4.278	-3.867	-5.594	-6.594	-7.753*	-7.106
	--	--	--	(3.193)	(3.091)	(3.453)	(3.958)	(3.811)	(4.312)
Hispanic	--	--	--	2.458*	2.403*	2.409*	3.158**	3.446**	2.823*
	--	--	--	(1.384)	(1.330)	(1.349)	(1.509)	(1.438)	(1.550)
Regulations	--	--	--	--	--	--	7.318	8.891	4.813
	--	--	--	--	--	--	(5.598)	(5.380)	(16.533)
Population	--	--	--	0.001	0.001	0.002	0.000	-0.001	0.001
	--	--	--	(0.002)	(0.002)	(0.002)	(0.004)	(0.002)	(6.838)
Density	--	--	--	0.010	0.009	0.011	0.021	0.018	0.019
	--	--	--	(0.019)	(0.019)	(0.019)	(0.022)	(0.020)	(0.022)
CPI	0.082	0.081	0.088	0.147	0.140	0.210	0.041	0.005	0.138
	(0.076)	(0.073)	(0.075)	(0.164)	(0.155)	(0.163)	(0.178)	(0.168)	(0.199)
CPI_Black	--	--	--	-0.002	-0.002	-0.001	0.000	0.001	0.001
	--	--	--	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
CPI_White	--	--	--	0.004	0.006	0.000	0.010	0.019	0.005
	--	--	--	(0.010)	(0.010)	(0.010)	(0.012)	(0.012)	(0.013)
CPI_Hispanic	--	--	--	0.001	0.000	0.003	0.001	0.000	0.003
	--	--	--	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.005)
Log_GDP	0.775*	0.838*	0.802*	-7.049	-6.454	-10.343	-8.988	-8.613	-10.901
	(0.458)	(0.445)	(0.456)	(6.635)	(6.461)	(7.290)	(6.812)	(6.440)	(7.895)
GDP_Black	--	--	--	0.189	0.237	0.147	0.220	0.246	0.138
	--	--	--	(0.277)	(0.272)	(0.272)	(0.301)	(0.284)	(0.316)
GDP_White	--	--	--	0.335	0.259	0.523	0.440	0.408	0.581
	--	--	--	(0.316)	(0.313)	(0.358)	(0.346)	(0.328)	(0.427)
GDP_Hispanic	--	--	--	-0.256*	-0.237*	-0.276**	-0.330**	-0.342**	-0.319**
	--	--	--	(0.135)	(0.130)	(0.134)	(0.147)	(0.139)	(0.149)
Log_Funding	--	--	--	--	--	--	0.574	0.188	-0.166
	--	--	--	--	--	--	(1.315)	(1.888)	(1.817)
Educ	--	--	--	--	--	--	--	--	--
	--	--	--	--	--	--	--	--	--
Age	-2.091***	-1.939***	-2.188***	-0.667	-0.370	-1.378	0.921	0.811	-0.371
	(0.645)	(0.608)	(0.606)	(2.263)	(2.143)	(2.148)	(2.598)	(2.275)	(2.387)
Yr_1995	0.707***	0.806***	0.735***	0.531**	0.667**	0.365	--	--	--
	(0.135)	(0.143)	(0.148)	(0.236)	(0.250)	(0.287)	--	--	--
Yr_1997	0.665***	0.745***	0.691***	0.058	0.159	-0.057	-0.571*	-0.698**	-0.5114
	(0.152)	(0.153)	(0.157)	(0.371)	(0.363)	(0.387)	(0.324)	(0.317)	(0.326)
Yr_1999	0.404**	0.453***	0.453***	-0.094	-0.041	-0.136	-0.763*	-0.895**	-0.5805
	(0.162)	(0.140)	(0.148)	(0.397)	(0.358)	(0.380)	(0.395)	(0.371)	(0.356)
Yr_2001	-0.133	-0.136	-0.114	-0.672	-0.694***	-0.645	-1.342***	-1.679***	-1.150**
	(0.169)	(0.160)	(0.164)	(0.434)	(0.410)	(0.413)	(0.477)	(0.499)	(0.470)
Yr_2003	-0.342**	-0.334**	-0.337**	-0.916*	-0.933**	-0.915**	-1.577***	-1.930***	-1.432***
	(0.163)	(0.159)	(0.163)	(0.458)	(0.440)	(0.446)	(0.516)	(0.535)	(0.520)
Yr_2005	-0.420**	-0.402**	-0.416**	-1.06**	-1.065**	-1.123**	-1.718***	-2.087***	-1.632***
	(0.179)	(0.175)	(0.180)	(0.489)	(0.471)	(0.486)	(0.570)	(0.584)	(0.573)
Observations	80	80	80	68	68	68	64	64	64
R^2	0.9414	0.9441	0.9412	0.9486	0.9515	0.9501	0.9549	0.9597	0.9533

The time trend variables that are not shown are not significant or lose their significance as more explanatory variables are used. Those that were not included in some regressions are those for which there is no observation for the corresponding year. All other variables from Table 1 and Table 2 which are not included in Table 3 were absorbed by the fixed effect variable. Standard deviations are in parenthesis. Coefficients significantly different from zero in a two-tailed t-test at the *ten percent level; **five percent level; ***one percent level are reported.

Table 5: Regressions of average number of cigarettes smoked

	Cigs								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Tax	0.001	--	--	-0.003	--	--	0.009	--	--
	(0.015)	--	--	(0.018)	--	--	(0.025)	--	--
Lag1_Tax	--	-0.026*	--	--	-0.042**	--	--	-0.057**	--
	--	(0.015)	--	--	(0.017)	--	--	(0.024)	--
Lag2_Tax	--	--	-0.001	--	--	-0.013	--	--	0.008
	--	--	(0.015)	--	--	(0.016)	--	--	(0.024)
Black	--	--	--	-0.016	-0.017	-0.016	0.026	0.010	0.030
	--	--	--	(0.014)	(0.013)	(0.014)	(0.221)	(0.217)	(0.222)
White	--	--	--	0.030	0.028	0.028	-0.895*	-0.705	-0.907*
	--	--	--	(0.047)	(0.047)	(0.047)	(0.473)	(0.465)	(0.479)
Hispanic	--	--	--	0.013	0.013	0.013	0.133	0.169	0.139
	--	--	--	(0.010)	(0.010)	(0.010)	(0.239)	(0.233)	(0.238)
Regulations	--	--	--	--	--	--	5.079	5.528	5.188
	--	--	--	--	--	--	(4.494)	(4.392)	(4.484)
Population	--	--	--	0.000	0.000	0.000	0.000	0.000	0.000
	--	--	--	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Density	--	--	--	-0.001	-0.001	-0.001	0.000	-0.001	-0.001
	--	--	--	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
CPI	--	--	--	--	--	--	-0.032	-0.021	-0.034
	--	--	--	--	--	--	(0.051)	(0.050)	(0.051)
CPI_Black	--	--	--	--	--	--	0.000	0.001	0.000
	--	--	--	--	--	--	(0.001)	(0.001)	(0.001)
CPI_White	--	--	--	--	--	--	0.002	0.001	0.002
	--	--	--	--	--	--	(0.002)	(0.002)	(0.002)
CPI_Hispanic	--	--	--	--	--	--	-0.001	-0.001	-0.001
	--	--	--	--	--	--	(0.001)	(0.001)	(0.001)
Log_GDP	--	--	--	--	--	--	-1.389	-1.166	-1.380
	--	--	--	--	--	--	(0.969)	(0.943)	(0.967)
GDP_Black	--	--	--	--	--	--	-0.012	-0.012	-0.011
	--	--	--	--	--	--	(0.017)	(0.017)	(0.017)
GDP_White	--	--	--	--	--	--	0.070*	0.063*	0.069*
	--	--	--	--	--	--	(0.038)	(0.037)	(0.038)
GDP_Hispanic	--	--	--	--	--	--	-0.001	-0.005	-0.001
	--	--	--	--	--	--	(0.022)	(0.021)	(0.022)
Log_Funding	--	--	--	--	--	--	--	--	--
	--	--	--	--	--	--	--	--	--
Educ	--	--	--	--	--	--	--	--	--
	--	--	--	--	--	--	--	--	--
Age	0.218*	0.223*	0.219*	0.199	0.194	0.208	0.189	0.192	0.164
	(0.115)	(0.114)	(0.115)	(0.187)	(0.185)	(0.187)	(0.250)	(0.244)	(0.255)
Yr_1994	-0.153***	-0.136***	-0.152***	-0.144***	-0.119***	-0.147***	--	--	--
	(0.022)	(0.021)	(0.019)	(0.028)	(0.027)	(0.025)	--	--	--
Yr_1995	-0.102***	-0.088***	-0.101***	-0.096***	-0.074***	-0.091***	--	--	--
	(0.021)	(0.020)	(0.020)	(0.028)	(0.027)	(0.027)	--	--	--
Yr_1998	-0.101***	-0.095***	-0.100***	-0.095***	-0.085***	-0.092***	-0.039	-0.049*	-0.038
	(0.020)	(0.020)	(0.020)	(0.031)	(0.031)	(0.031)	(0.029)	(0.029)	(0.030)
Yr_1999	-0.122***	-0.119***	-0.122***	-0.113***	-0.107***	-0.110***	-0.041	-0.059*	-0.043
	(0.021)	(0.020)	(0.021)	(0.032)	(0.032)	(0.032)	(0.036)	(0.033)	(0.034)
Yr_2000	-0.126***	-0.134***	-0.126***	-0.109***	-0.120***	-0.108***	-0.050	-0.086**	-0.049
	(0.019)	(0.019)	(0.019)	(0.030)	(0.030)	(0.030)	(0.037)	(0.038)	(0.038)
Yr_2001	-0.178***	-0.182***	-0.179***	-0.166***	-0.171***	-0.170***	-0.115***	-0.141***	-0.112***
	(0.019)	(0.019)	(0.020)	(0.031)	(0.031)	(0.031)	(0.041)	(0.040)	(0.045)
Observations	447	447	447	341	341	341	176	176	176
R^2	0.4254	0.4299	0.4254	0.4240	0.4359	0.4253	0.4421	0.4653	0.4421

The time trend variables that are not shown are not significant or lose their significance as more explanatory variables are used. Those that were not included in some regressions are those for which there is no observation for the corresponding year. All other variables from Table 1 and Table 2 which are not included in Table 3 were absorbed by the fixed effect variable. Standard deviations are in parenthesis. Coefficients significantly different from zero in a two-tailed t-test at the *ten percent level; **five percent level; ***one percent level are reported.

References

American Cancer Society. <http://www.cancer.org/downloads/COM/OH2006GASTipSheet.pdf> 2 November 2007.

Avery, Rosemary, Donald Kenkel, Dean Lillard, and Alan Mathios. "Private Profits and Public Health: Does Advertising of Smoking Cessation Products Encourage Smokers to Quit?" Journal of Political Economy 115.3 (2007): 447-481.

Campaign for Tobacco-Free Kids. <www.tobaccofreekids.org> 17 October 2007.

Campaign for Tobacco-Free Kids, American Heart Association, American Cancer Society, and American Lung Association. "A Broken Promise to Our Children: The 1998 State Tobacco Settlement Seven Years Later." 2005. <www.tobaccofreekids.org/reports/settlements/2006/fullreport.pdf> 18 October 2007.

Carpenter, Christopher, and Phillip Cook. "Cigarette Taxes and Youth Smoking: New Evidence from National, State & Local Youth Risk Behavior Surveys." NBER Working Paper No. 13046, April 2007.

CDC. <www.cdc.gov > 17 October 2007.

CDC.<http://www.cdc.gov/tobacco/data_statistics/sgr/sgr_2004/00_pdfs/SGR2004_Whatitmeanstoyou.pdf > 15 October 2007.

Central University of New York. <http://www.gc.cuny.edu/faculty/research_briefs/aris/aris_index.htm> 17 October 2007.

DeCicca, Philip, David Kenkel, and Alan Mathios. "Putting Out the Fires: Will Higher Taxes Reduce The Onset of Youth Smoking?" Journal of Political Economy 110.1 (2002): 144-169.

Federal Trade Commission. <http://www.ftc.gov/os/2002/05/2002cigrpt.pdf> 20 October 2007.

Fleenor, Patrick. "Cigarette Taxes, Black Markets, and Crimes: Lessons from New York's 50 year losing battle." Policy Analysis No.468 (2003).

Gruber, Jonathan and Sendhil Mullainathan. "Do Cigarette Taxes Make Smokers Happier." NBER Working Paper No.8872 (2002).

Gruber, Jonathan. "Youth Smoking In The U.S.: Prices And Policies, NBER Working Paper No.7506 (2000).

Jim's Burnt Offerings. <http://www.wclynx.com/burntofferings/adsjoecamel.html> 1 November 2007.

Northeastern University. <http://tobacco.neu.edu/tobacco_control/resources/msa/index.html#Chapter%20Six> 21 October 2007.

Northeastern University. <http://tobacco.neu.edu/tobacco_control/resources/msa/index.html> 22 October 2007.

Tan, Wei. "The Effects of Taxes and Advertising Restrictions on the Market Structure of the U.S. Cigarette Market." Review of Industrial Organization 28 (2006):

231-251.

TRUTH. <http://www.whudafxup.com/?ref=http://www.google.com/search?sourceid=navclient&aq=t&ie=UTF-8&rls=HPIC,HPIC:2006-35,HPIC:en&q=TRUTH> cited 20 October 2007.

University of Dayton, Ohio. <http://academic.udayton.edu/health/syllabi/tobacco/summary.htm#Marketing> 21 October 2007.

US Census Bureau. <http://www.census.gov/prod/www/religion.htm> 17 October 2007.

US Census Bureau. <http://www.census.gov/popest/states/asrh/tables/SC-EST2006-01.xls> 3 November 2007.