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Felix qui potuit rerum cognoscere causas
Atque metus omnis et inexorabile fatum

"Happy the man who has been able to learn the causes of things
And has trampled beneath his feet all fears, inexorable fate..."

–Vergil, *Georgics* (Book II, Line 490)

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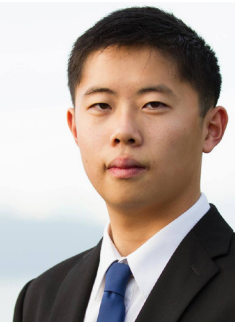

DANIEL GAO

President, Vancouver School of Economics Undergraduate Society

Dear Reader,

What you are currently reading not only marks the achievements of numerous students from the VSE, it is also the product of the extraordinary work done by the inaugural *IONA Journal of Economics* editorial team. Not enough credit can be given to Terralynn Forsyth, our Founder and Editor-in-Chief, for leading the editorial team through its first year. This team has pored over all facets of the journal, including editing, printing and marketing, and the Vancouver School of Economics Undergraduate Society (VSEUS) could not be more proud to be a supporter of this journal and the team behind it.

When VSEUS was officially formed in February of 2015, the society made it a key part of its guiding principles to provide more avenues to engage our students. One idea that arose from this included the development of one of the largest undergraduate economics journals in Canada. That idea has ultimately resulted in the paper you hold in your hands or the digital copy you see on your screen. The IONA Journal is meant to challenge our students to explore their curiosities within economics or other disciplines, provide a method for them to have their work published and show that even novice scholars, whom are just beginning their journey into academia, are capable of astounding research.

I hope that what follows in the following pages will attract your interest, spark your curiosity and expand your knowledge. Everyone who has worked on this journal has put in countless hours to ensure that ultimately you, our reader, can gain something from having read the *IONA Journal of Economics*. Thank you for taking the time to pick up our journal, and I wish you happy reading.

Best,

Daniel Gao
President, Vancouver School of Economics Undergraduate Society

THOMAS LEMIEUX

Director, Vancouver School of Economics

Faculty Forward

Dear Reader,

The Vancouver School of Economics is delighted to support the launch of the student-led *IONA Journal of Economics.* While the journal's title pays tribute to our new home—the historic Iona building, the building itself was named for the monastic community in the Scottish Hebrides. During the early middle ages, the island of Iona was one of the greatest centres of learning in Northern Europe, where invaluable documents were produced and preserved. The *IONA Journal of Economics* thus celebrates our new beginning with the writing of emerging researchers while coincidentally paying homage to millennia of learning and scholarship.

This is a time of excitement and optimism for the VSE. One of the main rationales for establishing the Vancouver School of Economics in 2012 was to create a home for all economics students at UBC—to provide a central place where research, teaching, learning and social activities could be integrated and a sense of identity forged. Our recent move to the Iona Building in December 2015 has created a hub of activities and a natural place for economics students to congregate while on campus. The Iona building provides state-of-the-art learning and research facilities, as well as social spaces for faculty, staff and students. The VSE has been closely collaborating with the VSEUS to insure we fully exploit this wonderful new facility we have on campus, and give all students a better sense of belonging to the School.

One of our greatest hopes for the new VSE and the move to the Iona Building, is the opportunities created for involving undergraduate students in research and other scholarly activities. As a leading economic research department, the VSE has been committed to providing research opportunities for all major, honours and BIE students. One means of doing this has been

through a capstone project or thesis written under the supervision of faculty members. More recently there has been an increasing collaboration of research faculty with undergraduate academic assistants. But much more could be done, and I very much hope that the launching of the *IONA Journal of Economics* will provide a unique opportunity of featuring the exciting research work being done by VSE undergraduate students, and providing a platform for the exchange of ideas related to economics among students. Congratulations to the founding team of student editors for their outstanding work launching the Journal. I am confident the Journal will quickly establish itself as one of the leading undergraduate journals in the field and will be a launching pad for many successful careers in economics!

In academia we can become too attached to, even constrained, by our separate roles as teachers, students and researchers and the lack of a central physical space for us to interact has somewhat limited opportunities for interaction between our groups. But we are all teachers, we are all learners and we are all explorers. In a scholarly community the roles of teacher, student and researcher are equally important and synergetic. Out of this synergy new opportunities and ideas will form. The IONA Journal is emblematic of that synergy and optimism—a new, entirely student-initiated enterprise arising out of the integration of research, teaching and learning. While our students' scholarship forms the heart of this enterprise, the *IONA Journal of Economics* provides an opportunity for all members of the VSE—students, faculty and staff—to assist in building a piece of our new identity, and I heartily encourage you all to support this brave new endeavour.

Sincerely,

Thomas Lemieux
Director, Vancouver School of Economics

Letter from the Editor-in-Chief

TERRALYNN FORSYTH

Founder and Editor-in-Chief, IONA Journal of Economics

Dear Reader,

Words cannot express the esteemed honour and gratitude I feel to have the opportunity to welcome you to the inaugural volume of the *IONA Journal of Economics*, Volume I 2016.

In its founding year, the *IONA Journal of Economics* purposed to establish itself as more than just a journal of undergraduate research in the field of economics. We have made it our mission to go beyond setting the stepping stones to undergraduate publication, guided by a vision to connect a community dedicated to the advancement of "the knowledge of the causes of things." A common thread throughout humanity, this drive to understand the world and construct solutions to improve it laid the foundations to the academic pursuit. From a desperate need to comprehend the cosmos to understanding our own 'benevolent interests', our curious quest of knowledge brings us here. IONA and the diverse community it has fostered in its first year is a testament to the value that abounds between the multiple dimensions of the economic discipline as a social science.

As a name, IONA serves as an icon—connecting us with this historical drive to create, preserve and spread knowledge. The name "Iona" originates from an island off of Scotland that once served as a middle-age 'knowledge hub' through the copying and preservation of written manuscripts. The community was founded by a prolific scribe, Colmcille, now credited with saving the church's literary treasurers during Europe's Dark Ages, when book burning was a common practice amongst religious zealots. His mission was simple. He recognized the shortage of books as one of the critical paths restricting the growth of the scholarship—pushing him to copy, study and disperse the literary materials of the church. Soon falling under persecution from higher authorities in a middle-age

copyright dispute, the scribe set sail for Iona in Scotland to continue his mission.[1]

IONA pays homage to the many efforts like those of Colmcille that have preceded the journal's founding and its many volumes to come. Technology, like any socio-economic force, has transformed the architecture underlining the copy, study and dispersion of knowledge. In the present age where information is now expansive, accessible and abundant, IONA serves as a platform for our undergraduates to showcase their own 'literary treasurers'. It is common place in the undergraduate world for great work to be left behind to collect dust on a shelf. On a campus vibrant with student life and resources, this is unfortunate and unnecessary.

In addition to their skilled composition, research aptitude and originality, the papers and research features published in this volume showcase a wide variety of topical areas within economics. Included are highly technical pieces covering topics like energy policy, experimental design and finance, such as McLean's "Promoting Green Power," Pai's "No Two Experiments Are Identical" and Zhang's "Oil Price Fluctuations and Canada's Exchange Rates." Kotb's "Ricardo's Theory of Mechanization" intertwine political and philosophical economy and Momtahen's "Women's Autonomy in Red India" uses a technical approach to deconstruct social dynamics and political outcomes in India. Additionally, Irhamni's "Structural Adjustment or Structural Violence?" takes an anthropological approach to neoliberal economic policies and their effect on the Ebola epidemic in West Africa. We've also included an external research feature, "GDP Growth Engines for Least Development Countries and Policy Recommendation" authored by the 1st place undergraduate team in our Big Data Big Impact {Economics} Data Science Competition. Lastly, we have the pleasure to include an honours thesis from the previous

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1 Special thanks to Dr. Hugh Neary for the discussion and reference: Ray Corrigan,"Colmcille and the Battle of the Book: Technology, Law and Access to Knowledge in 6th Century Ireland," The Open University (2007): http://oro.open.ac.uk/id/eprint/10332.

academic year, Koerner's "Trade Liberalization, Child Labour, and Human Capital Investments in Brazil."

From the diversity of the pieces featured in this volume to the range of projects that IONA has undertaken this year, we have not been shy in our ambitions. In addition to our annual publication, IONA has established a comprehensive online platform, the IONA Research Unit, which produces a podcast series with professors and op-ed content from our editors and students. We've also recently partnered with DataSense Vancouver in the first Big Data Big Impact {Economics} Data Science Competition, promoting the use of data science tools and concepts in the socio-economic context. We look forward to expanding these projects in the coming years.

While our efforts have been expansive, the support received along the way has surpassed expectation. I would like to express my utmost gratitude to all those involved in any and all stages of the founding and production of IONA. The IONA Editorial and Creative Teams have gone above and beyond in making our first volume possible. Our Faculty Review Committee has guided us through the peer review process, offering invaluable advice along the way. Special thanks is given to the VSE Associate Director, Dr. Hugh Neary, for his unwavering support and sound guidance. A big thank you is also extended to the VSE and VSEUS for their partnership along the way and to all of our sponsors that have made our initiative possible.

Lastly, I would like to thank you, the reader—the curious and the modern inquisitive—for your interest and continued support. May your intellectual curiosity continue to be its own reason as you turn the pages that follow.

Sincerely,

Terralynn Forsyth
Founder, Editor-in-Chief

IONA Journal of Economics Volume I 2016

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I

PAPERS

Structural Adjustment or Structural Violence?

EXAMINING EBOLA EPIDEMIC IN WEST AFRICA UNDER NEOLIBERAL POLICY

Riza Irhamni

INTRODUCTION

The 2014 outbreak of Ebola Virus Disease (EVD) in West Africa has resulted in high mortality rates and social suffering for West African people, illustrating the inadequacy of health care institutions in the region. The recent Ebola outbreak is the first in the West African region and the largest and longest Ebola epidemic, in which three countries (Sierra Leone, Guinea and Liberia) were severely affected (Piot et al. 2014). It has been argued that regional cultures have played an immense role in the spread of EVD in West Africa (Jones 2011). We must, however, consider other explanations, such as the further deterioration of poor health infrastructure in these countries and the underlying reasons for such impoverished infrastructures. A vast body of literature has addressed this issue, and there are substantial connections between the role of Structural Adjustment Programs (SAPs) under neoliberal economic policies in sub-Saharan Africa and the collapse of health care systems in these developing countries. Many scholars argue that the implementation of SAPs under the neoliberalist policies of the International Monetary Fund (IMF) and the World Bank has negatively impacted health care

systems. Furthermore, they emphasize that these International Financial Institutions (IFIs) should re-evaluate their strategy on poverty reduction and economic growth stimulation in many developing countries (Demissie 2008; Ellison 2014; Foley 2008; Foster 2005; Hoddie et al. 2014; Jones 2011; Melly 2011; Pfeiffer 2002; Pfeiffer et al. 2010; Ravindran 2014; Rylko- Bauer et al. 2002). This paper focuses specifically on the relationship between structural factor reforms and the recent Ebola outbreak in West Africa, concluding that neoliberal policies and structural factors are fundamental determinants contributing to structural violence in West African health care systems and the collapse of such systems amidst the Ebola outbreak.

I will first recount the situation on the ground—what happened when the health care systems collapsed in the middle of the outbreak. Secondly, I will analyze the history of neoliberalism and the implementation of SAPs by the two IFIs. This section will reveal the relationship between SAPs and the outbreak by conveying the policies' impact on developing countries in the past. I will then examine the correlation between SAPs and the Ebola epidemic by reviewing the effect of structural adjustments on the health care systems in various African countries. By comparing the impact of neoliberal policies on health care systems in these countries, we will see the overall effect of structural adjustments on health care systems in West Africa. Although these patterns show strong correlations between SAPs and the outbreak, they do not necessarily imply direct causation. By studying the significance of SAPs on health care systems, I will demonstrate how structural adjustment may have led to structural violence in the communities of West Africa.

WHEN THE SYSTEMS COLLAPSED

A key difference between the recent Ebola epidemic and previous outbreaks is its size and spread, rather than the emergence of a more virulent Ebola virus (Piot et al. 2014). According to Centre for Disease Control and Prevention (2016), the number

of cases reached 27,000 across three countries, while the second largest outbreak in recent history (Uganda in 2000-2001) totaled 425 cases. The official Ebola case numbers in West Africa are almost certainly understated, as many Ebola infected patients in rural areas may have died without even reaching clinics or hospitals. The real figure is also likely to be hindered by collateral deaths caused by the collapse of the countries' health care systems (Africa Research Bulletin 2014). EVD existed in Africa long before the recent epidemic, but when an outbreak of this scale occurred, the understaffed, unequipped hospitals were likely to intensify, rather than impede a major epidemic (Dahn et al. 2015). Ebola in itself is an emergency within a larger emergency, rooted in this lack of health resources (Thompson 2014). This larger emergency was left unresolved due to systemic failures and has been going on for decades in these countries.

There are many factors contributing to the spread of Ebola hemorrhagic fever, including decades of civil war and armed conflict (causing high levels of mobility across borders and lack of trust in the government), strong traditional beliefs in disease etiology (denial of germ and virus theory), and high-risk traditional funeral practices that amplify the probability of transmission (in addition to healing practices, where the bodies of Ebola infected persons are touched). The emergence of the Ebola epidemic is also commonly affiliated with traditional cultural practices, such as bushmeat (wild/non-domesticated animal meat) consumption and funeral rituals (Piot et al. 2014). Although culture may be partly responsible for disease transmission, Jones (2011) argues that this emphasis on culture as the cause of Ebola transmission is misleading: "the assumption of African 'otherness,' rather than evidence (...) underpins dominant culturalist logics that 'beliefs' motivate behaviours which increase the likelihood of Ebola's emergence and spread." [1]He argues that we must take into account structural factors, which influenced this outbreak of Ebola far more than culture, emphasizing that "inequality and inadequate

1 Jared Jones, "Ebola, Emerging: The Limitations of Culturalist Discourses in Epidemiology," *Journal of Global Health* 1(1) (2011): 1.

healthcare, exacerbated by a legacy of colonialism, superpower geopolitics, and developmental neoliberalism, are responsible for much of Ebola's spread."[2]

Phillips (2014) agrees with Jones (2011) in this regard. He adds that other elements related to developmental neoliberalism may be partly responsible for the outbreak, such as the economic market's role in pharmaceutical companies' refusal to invest in research, and the neoliberal policies' exacerbation of the outbreak on the ground. Rob Wallace, a phylogeographer and ecologist, analyzes how the failure of neoliberal policies has established the ideal environment for an epidemic (Phillips 2014). For instance, bushmeat eating or game hunting is an indirect result of neoliberal policies. Under structural adjustments, people are forced off their land "without accompanying urban employment opportunities (...) they plunge deeper into the forest to expand the geographic as well as species range of hunted game, enhancing their risk of exposure to Ebola virus and other zoonotic pathogens in these remote corners."[3]

GOOD INTENTIONS, BAD OUTCOMES THE ROLE OF IMF AND THE WORLD BANK

The emergence of Structural Adjustment Programs can be attributed to the global economic downturn in the 1970s. Following the international debt crisis, economic elites shifted from Keynesian principles of government intervention and subsidy to Monetarism under neoliberalism (Pfeiffer et al. 2010). Neoliberalism's main principles are individualism, free market via privatization and deregulation and decentralization (McGregor 2001). McGregor argues that under neoliberalism, public services, such as health care, are commodities to be sold.[4] In hopes to cut

2 Ibid., 1.

3 Leigh Phillips, "Political Economy of Ebola," accessed April 6, 2015, https://www.jacobinmag.com/2014/08/the-political-economy-of-ebola/.

4 Sue McGregor, "Neoliberalism and Health Care," *International Journal of Consumer Studies* 25(2) (2001): 82.

down national debts and stimulate the economy in many developing countries, governments employed IFI-mandated structural adjustments, privatizing and cutting subsidies for health care and other publicly funded social services.

In the 1980s, the IMF introduced the Enhanced Structural Adjustment Facility (ESAF)—a credit package offered to poor countries, only if the recipient governments met the macroeconomic conditionalities (Pfeiffer et al. 2010). The conditionalities included in the implementation of Structural Adjustment Programs were enforced to conform to neoliberalist policy. These SAPs were intended to help governments of developing countries restructure their economies, mainly to repay international debt and to promote economic growth. The two IFIs then assisted these governments by providing them with *more* loans. Under these conditionalities, governments had to cut public goods spending (primarily on health care and social services), eliminate market intervention of subsidies and price controls, devalue local currency, open trade by reducing taxes on foreign investments, and deregulate certain public sector activities (Pfeiffer et al. 2010). The World Bank then encouraged the establishment of health insurance to "help governments direct stable revenue streams to private sector health care providers as an incentive for their participation in 'the business of healthcare.'" [5]Under neoliberalism, private, for-profit insurance providers substitute government programs that cannot sufficiently provide health care to citizens. The World Bank's promotion of universal health coverage (through health insurance) was intended to increase investment in the health sector (Ellison 2014). Nonetheless, in the 1990s, health indicators (mortality and morbidity) were deteriorating across Africa. The promises of economic growth and the reduction of debt levels were not fulfilled; economies were still weak and international debt levels were still very high.

The policies of the IMF and World Bank were initially directed towards positive goals of economic development (Hoddie

5 James Ellison, "First-Class Health: Amenity Wards, Health Insurance, and Normalizing Health Care Inequalities in Tanzania," *Medical Anthropology Quarterly* 28(2) (2014): 169.

et.al 2014). These policies, however, did not consider the national interests of states participating in these structural adjustments. I regard it as a new way of the 'West' imposing economic intervention on the developing countries without truly recognizing the very substantive difference in their economic systems. The structural reforms have placed heath care responsibility on the individual rather than the government, no matter how the individual acquires the disease or sickness, whether it is due to poverty, social inequality, chance or lifestyle changes. These reforms have completely transformed health care systems in developing countries and changed how individual households react and make decisions in times of illness. Under these cuts, the most vulnerable were affected—these people could not afford private health insurance or readily pay the cost of health care when they were infected with the Ebola virus. The benevolent intentions of IFIs in this region may have influenced the scale of this outbreak.

NEGATIVE IMPACTS OF STRUCTURAL ADJUSTMENTS IN SUB-SAHARAN AFRICA

A wide range of literature acknowledges the inequalities and the deteriorating nature of health care systems due to SAPs (Demissie 2008; Ellison 2014, Foley 2008; Foster 2005; Hoddie et al. 2014; Jones 2011; Melly 2011; Pfeiffer 2002; Pfeiffer et al. 2010; Ravindran 2014; Rylko-Bauer et al. 2002). Ravindran (2014) accentuates that "to be an advocate for universal access to health and health care is to become an advocate against neoliberal globalization."[6] Hoddie et al. (2014) find that SAPs in the short term, "raise the exposure of populations to conditions that increase incidences of disability and death."[7] Contrary to the claims made

6 TK Sundari Ravindran, "Poverty, Food Security and Universal Access to Sexual and Reproductive Health Services: a Call for Cross-Movement Advocacy Against Neoliberal Globalisation," *Reproductive Health Matters* 22(43) (2014): 14.

7 Matthew Hoddie and Caroline Hartzell, "Short-Term Pain, Long-Term Gain? The Effects of IMF Economic Reform Programs on Public Health Performance," *Social Science Quarterly* 95(4) (2014): 1021.

by advocates of SAPs, there is evidence that these programs are harmful for public health standards in the long term. Hoddie et al. (2014) highlight the immediate and continuing negative influences of SAPs on public health care. Their study concludes by suggesting that the IMF reconsider its structural approaches. Hoddie et al. (2014) argue that these 'liberalizing' programs "produce both direct and indirect effects (...) with consequences of endangering the well-being of a state's population."[8]

Many scholars also argue that SAPs and other conditionalities introduced by IFIs have contributed to the poor quality of healthcare infrastructures in Africa. Jones (2011) accentuates that "healthcare spending dropped precipitously, needed hospitals were not built, salaries went unpaid, hospitals were left understaffed, and many of the best and brightest doctors left the African countries because of the despicable hospitals and lack of opportunities."[9] Pfeiffer (2002) states that in order to maintain the neoliberal emphasis on privatization, international aid was provided to non-governmental organizations (NGOs) in developing countries. His article focuses on the Mozambique experience under neoliberalism and reveals that the explosion of NGOs over the last decade has "fragmented the local health system, undermined local control of health programs, and contributed to growing local social inequality."[10] Foley (2008) then adds that neoliberal policies, along with structural reforms, "have dramatically affected susceptibility to disease and health-seeking strategies throughout the continent."[11] Although they were intended to promote economic growth, they were responsible for the collapse of many public sectors across the continent.

In Ethiopia, the adoption of market-oriented structural

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8 Ibid.,1040.

9 Jared Jones, "Ebola, Emerging," 4.

10 James Pfeiffer, "International NGOs and Primary Health Care in Mozambique: the Need for a New Model of Collaboration," *Social Science and Medicine* 56 (2002): 725.

11 Ellen Foley, "Neoliberal Reform and Health Dilemmas: Social Hierarchy and Therapeutic Decision Making in Senegal," *Medical Anthropology Quarterly* 22(3) (2008): 257.

reforms has proven very ineffective in addressing many structural problems in the country; they further heightened existing problems in Addis Ababa (Demissie 2008). In Uganda, biomedical technologies were transferred to private and informal sectors of health care, and the public system was weakened under the adjustment (Pfeiffer et al. 2010). Foster (2005) discusses the impact of neoliberalism in post-apartheid South Africa, finding that the relationship between health staff and local communities has deteriorated due to state budget cuts. In Zimbabwe, SAPs hinder the relationship between health staff and patients, as demand for health care is increasing but salaries of health staff are declining (Pfeiffer et al. 2010). In Mozambique, long waiting times and poor health infrastructure prevent mothers from obtaining the natal care they need. In Tanzania, Ellison (2014) conveys that SAPs have reduced peoples' access to biomedical care because they cannot afford health insurance, and the systematic structuring of inequalities has become normalized. Also in Tanzania, ethnographic findings reveal "normalization of biomedical care and health as individualized commodities," and the discussion of rights to health care were abstract and considered unrealistic.[12]

STRUCTURAL ADJUSTMENT OR STRUCTURAL VIOLENCE?

According to Paul Farmer et al. (2006), the term 'structural violence' is a way of describing "social arrangements that put individuals and populations in harm's way—these arrangements are structural because they are embedded in the political and economic organization of the social world, they are violent because they cause injury to people (typically, not those responsible for perpetuating such inequalities)."[13] Farmer (2004) points out that structural violence is often entrenched in longstanding

12 James Ellison, "First-Class Health," 176.

13 Paul Farmer, Bruce Nizeye, Sara Stulac, and Salmaan Keshavjee, "Structural Violence and Clinical Medicine," *PLos Medicine* 3(10) (2006): 449.

"ubiquitous social structures, normalized by stable institutions and regular experience."[14] He further demonstrates that structural violence appears normal in society, since its presence is almost invisible. In other words, structural violence is symbolic. It does not become a part of people's consciousness, especially that of people who are suffering from such violence. Structural violence is often difficult to identify because the victims become desensitized to the repeated experiences of structural inequality. The violence itself is built on the institution, a broad norm that encompasses social suffering.

Structural violence also offers "an alternative lens to reinterpret disease and mortality among the poor as a form of violence that derives from structured inequality."[15] SAPs helped establish these structured inequalities in the case of the Ebola epidemic. Market-based health care and neoliberal health policy are missing a large proportion of what makes up health care—the patient's perspective and illness experience, especially of those who are most vulnerable to these adjustments due to their economic and social situations (Rylko–Bauer et al. 2002). Foley (2008) mentions that medical anthropologists working in Africa, where SAPs were implemented, must continually deal with the fallout of neoliberal policies and the structural violence it has produced. She argues that these reforms are based on a "narrow economic logic that fails to acknowledge the complexity of vulnerability to disease, illness experiences, and health-seeking behavior."[16]

Structural adjustment breeds structural violence because its 'arrangements' have harmed many individuals and a large proportion of the African population. I consider these reforms to be correlated with structural violence because they are ingrained in the political, economic and social structures of the societies in which they are implemented. The prolonged effects of social

14 Paul Farmer, "An Anthropology of Structural Violence," *Current Anthropology* 45(3) (2004): 307.

15 James Pfeiffer and Rachel Chapman, "Anthropological Perspectives on Structural Adjustment and Public Health," *The Annual Review of Anthropology* 39 (2010): 150-153.

16 Ellen Foley, "Neoliberal Reform and Health Dilemmas," 258.

suffering have become normalized, and thus unnoticeable in populations, especially for the people who are most affected by these structural reforms.

STRUCTURAL VIOLENCE IN WEST AFRICA: EBOLA EPIDEMIC CORRELATION WITH SAPS

Ebola transmission has been associated with African culture due to its origin and continued spread in Africa. Although I acknowledge that culture is influential in the spread of the disease, there are further underlying issues that may cause this spread, especially in the context of the West African epidemic. I argue that there are significant driving forces and determinants other than the culturist explanation that facilitate the spread of Ebola.

Hooker et al. (2014) argue that many elements of the outbreak are characterized by the chronic health care crisis that has been going on for decades, the root causes of which are strongly related to neoliberal policies. The lack of vaccines and antiviral drugs for Ebola prove that "markets cannot reliably supply treatments for epidemic diseases where the number of affected individuals is small."[17] Furthermore, public health infrastructures needed to contain, treat, and prevent infectious diseases, such as Ebola, have been deteriorating over the past 40 years, and are perhaps non-existent in many West African countries (Hooker 2014). When the health care system collapsed with the Ebola epidemic, there was no alternative system or resources available to contain the spread of the outbreak. This phenomenon is a form of structural violence, in which the indirect outcome of economic and social 'arrangements' adversely affected marginalized and vulnerable West African populations. The perplexing character of neoliberal policy exacerbated the effects of the outbreak in these West African countries when the market failed to produce

17 Claire Hooker, Christopher Mayes, Chris Degeling, Gwendolyn Gilbert and Ian Kerridge, "Don't be scared, be angry: the politics and ethics of Ebola," *Medical Journal of Australia* 201(6) (2014): 351.

effective drugs, or when the lack of health infrastructures failed to contain the spread of Ebola. Hooker et al. (2014) argue that the deteriorating public infrastructures (health and social) have made the prevention and containment of infectious diseases very difficult. This crisis exemplifies the importance of infrastructures and resources in containing outbreaks, since an outbreak is generally determined by the "extent of mortality and morbidity."[18] High levels of mortality in this outbreak were largely manipulated by structural factors, in which health care infrastructures were not built, and health resources were rapidly exhausted. Structural violence exists in West Africa where structural adjustments directly and indirectly caused an immeasurable amount of social suffering, especially in the case of the Ebola epidemic.

CONCLUSION

After exploring the underlying issue behind structural adjustments through the discussion of structural violence, this paper concludes that there is a strong correlation between the recent Ebola epidemic in West Africa and the implementation of SAPs under neoliberalism. Despite the difficulty and complexity of identifying structural violence in a society, the case of the recent Ebola epidemic, as many scholars have argued above, indeed resulted from structural violence. SAPs have imposed a significant burden on health care systems, and are partially liable for the collapse of West African healthcare systems and infrastructures. Structural violence has been present in West Africa since the structural adjustments commenced in the 1970s, however, the issue of structural violence has not come to the surface until the recent Ebola epidemic. Structural adjustments in West Africa evolved into structural violence under neoliberal policy, deteriorating health care systems, highlighting pre-existing economic inequalities and exacerbating the outbreak of EVD in the region.

18 Ibid., 353.

Ricardo's Theory of Mechanization

A PHILOSOPHICALLY INCONSISTENT THEORY

Shereen Kotb

This paper will investigate the philosophical consistency of David Ricardo's theory of mechanization after he revoked his stance in the third edition of *On the Principles of Political Economy and Taxation*. I will conduct this investigation by drawing on the following three scholars: John Davis,[1,2] Gianluca Femminis,[3] and Ferdinando Meacci.[4] In this paper, I will support Davis's argument that Ricardo's revised theory of mechanization is not consistent with his commitment to philosophical naturalism. I will make this argument, firstly, by providing a brief background of Ricardo's theory of mechanization and the revision it underwent. Secondly, I will show that, in the debate between Davis and Femminis, Davis is correct in arguing against Femminis' claim that Ricardo's revised theory of mechanization is consistent with his commitment to philosophical naturalism. Finally, I will

1 Davis, John. "Femminis and Salanti on Ricardo and Philosophical Naturalism: Rejoinder." *History of Political Economy* 27, no. 1 (1995): 101-06.

2 Davis, John. "Distribution in Ricardo's Machinery Chapter." *History of Political Economy* 21, no. 3 (1989): 457-80.

3 Femminis, Gianluca. "Davis on Ricardo's Machinery Chapter: A Comment." *History of Political Economy* 27, no.1 (1995): 89-99.

4 Meacci, Ferdinando. "Further Reflections on the Machinery Question." *Contributions to Political Economy* 17, no. 1 (1998): 21-37.

demonstrate that the inconsistency in his philosophical foundations implies that Ricardo I (the holder of the original opinion) and Ricardo II (the holder of the revised opinion) cannot both be right, contrary to Meacci's argument.

In the three editions of the *Principles*, Ricardo's economic theory does not undergo drastic change except for the addition of Chapter 31, "On Mechanization". He previously held the stance that the introduction of labour-saving machinery was a general good, except for the inconvenience of temporary unemployment. By contrast, his third edition of the *Principles* argues that mechanisation harms the labouring class by resulting in technological unemployment.

As Ricardo significantly redirects his views on mechanization, without altering the rest of his economic theory, this raises questions about the overall consistency of his theory. As Davis argues, "Later editions [of a work] are accordingly the occasion for clarification and sharpening of the argument, but also as often the occasion for its redirection and adjustment in ways that often compromise the author's original intent and conception."[5] Therefore, Ricardo's revised theory must be critically evaluated for its philosophical consistency.

Notably, Davis and Femminis have debated the consistency of the philosophical foundations of Ricardo's theory of mechanization. Both scholars agree that Ricardo was a philosophical naturalist—that is, he believed that "the laws of political economy are ultimately given by nature."[6] In other words, philosophical naturalism is the principle that the laws that govern political economy are unchanging and not subject to human transformation.[7] Femminis does not provide a justification for his opinion that Ricardo is a philosophical naturalist. He simply states that "substantial consensus is found even among historians of economic thought in recognizing some naturalistic influences within classical economics."[8] Unlike Femminis, Davis provides a more

5 Davis, "Distribution in Ricardo's Machinery Chapter," 457.

6 Davis, "Distribution in Ricardo's Machinery Chapter," 459.

7 Ibid.

8 Femminis "Davis on Ricardo's Machinery Chapter," 92.

compelling justification for characterizing Ricardo as a philosophical naturalist. For one, he quotes Ricardo as stating that he is primarily concerned with "the laws which regulate natural prices, natural wages, and natural profits..."[9] Furthermore, Davis argues that the principles that Ricardo applies to his theory, such as the Malthusian law of population and the law of the diminishing fertility of the soil, are grounded in philosophical naturalism. While the former is based on natural biological patterns of reproduction, the latter is based on physico-chemical properties, i.e. the physical chemistry of the soil.[10]

Davis and Femminis also agree on the definition of philosophical naturalism. While the general definition of the term is given by Davis in the above paragraph, Femminis rightly distinguishes between two elements of philosophical naturalism and argues that such a distinction is important in assessing the consistency of Ricardo's theory. The first of these is the objective, or deterministic, element of philosophical naturalism, which focuses on the way natural laws determine social and economic phenomena. It views these laws as "immutable forces which man cannot deflect or impede."[11] The second is the subjective element of philosophical naturalism, which focuses on the way in which natural laws produce the best possible outcome and, ultimately, social harmony. In other words, it is the philosophical belief that the best possible outcome is achieved when natural forces are left to run their course without human intervention—a view that laissez-faire economists hold.[12]

According to Femminis, in order to argue over the philosophical consistency of Ricardo's theory, it is important to distinguish between objective and subjective elements of philosophical naturalism and identify the element to which he adheres. To illustrate, Femminis argues that when Ricardo warns against state intervention limiting the introduction of machinery, he undermines

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9 Davis, "Distribution in Ricardo's Machinery Chapter," 460.

10 Ibid, 461.

11 Femminis "Davis on Ricardo's Machinery Chapter," 93.

12 Ibid.

the subjective but not the objective element of philosophical naturalism. He undermines the subjective element by showing that when natural forces are allowed to run their course, they do not necessarily result in social harmony. In this case, mechanization harms labourers by causing technological unemployment. Yet, he does not undermine the objective element. When Ricardo argues against state intervention, it is on the basis that limits on machinery would cause capital outflow to countries without such limits. Such outflow would be driven by competition, and as competition is typically viewed as a natural phenomenon, Ricardo's revised theory of mechanization does not undermine the objective element of philosophical naturalism. Natural laws continue to govern economic phenomena.

While Davis[13] later acknowledges that Femminis's distinction between the elements of philosophical naturalism is valid, the two scholars disagree about the element that Ricardo holds. While Davis believes that he adheres to the subjective element, Femminis argues that Ricardo's theory observes the deterministic one. Femminis uses the example of Ricardo's warning against government intervention to show that while Davis rightly argues that Ricardo undermines the subjective element, he does not undermine the objective element. And as Femminis claims that Ricardo adheres to the objective element, he argues that Ricardo's theory remains philosophically consistent.

In response, Davis argues that it actually does not matter which element one believes Ricardo is committed to because, ultimately, he undermines both. While it has been shown by both scholars that Ricardo undermines the subjective element of his philosophy, Davis goes on to demonstrate that he also undermines its objective element. Ricardo does this by "changing his position on the extent to which he believes society can impede certain natural forces."[14] In his theory, Ricardo holds the view that profits are determined by natural forces, and in particular, by the law of diminishing returns in agriculture. As less-arable

13 Davis, "Femminis and Salanti on Ricardo."

14 Davis, "Femminis and Salanti on Ricardo," 105.

land is cultivated, the price of food rises, which increases the subsistence wage. As wages increase to meet subsistence level, profits necessarily decrease. Ricardo maintains this perspective in his third edition of the *Principles*, except for in his chapter on mechanization. In it, the introduction of labour-saving machinery temporarily increases profits. Thus, "the invention and emplacement of machinery enables [society] to better deflect or impede those natural forces operating on the economy."[15] Had machinery been a natural force, like competition in the previous example, the objective element of philosophical naturalism would not have been undermined. However, Davis points out that because the development of machinery is "largely to be explained in terms of the advance of science, knowledge, and technology, whose progress is rarely explained in terms of the laws of nature," Ricardo's theory of mechanization does in fact undermine the objective element of philosophical naturalism.[16]

Like Davis, Meacci argues that Ricardo is inconsistent in his theory of mechanization. However, unlike Davis, Meacci finds that the inconsistency is in the assumptions that Ricardo I and Ricardo II operate on, and not in the philosophical foundations of his theory. Meacci's argument rests Paul Samuelson's distinction between invention and conversion. This distinction illuminates that an invention does not necessarily involve the conversion of circulating capital into fixed capital.[17] To illustrate, Meacci cites Ricardo's example of the corn mill. If it were discovered that the workers who turn a corn mill could produce more corn with the assistance of wind or water, and *if the wage fund is in no way impaired*, this would be an invention without conversion.[18] Inventions of this sort do not harm labourers. By not converting circulating capital into fixed capital, they do not permanently displace labourers. While inventions that involve this sort of conversion do, in fact, permanently displace labourers, as Ricardo II feared. Therefore,

15 Ibid.

16 Ibid.

17 Meacci, "Further Reflections," 26.

18 Ibid, 25.

Meacci concludes that both Ricardo I and Ricardo II are correct, and that the reason they differ in their conclusions is because they operate on different assumptions. Meacci sees that while Ricardo's original opinion assumes invention without conversion, his revised stance assumes invention with conversion.[19]

Although it may be true that Ricardo I and Ricardo II are inconsistent in the assumptions that underlie their arguments, Meacci's conclusion that both stances are nevertheless correct is flawed. It is not possible to simultaneously accept both the positions of Ricardo I and Ricardo II, for the very reason that they are inconsistent in their philosophies. As argued by Davis, they do not hold the same views on the extent to which they believe natural forces determine economic phenomena. This can be illustrated through the example of the determinants of wages. Ricardo I holds the view that wages are determined by natural forces i.e. the law of diminishing fertility of the soil and Malthus's law of population. Natural wages will always be at the subsistence level, which is determined by the law of diminishing fertility of the soil. When the market wage is above the natural wage, this will encourage population growth, which will then increase the supply of labour and push the market wage to the level of the natural wage. The introduction of labour-saving machinery will not affect wages. As Meacci argues, Ricardo I assumes invention without the conversion of circulating into fixed capital. Workers will simply be relocated to other sectors of the economy. On the other hand, Ricardo II holds the view that wages are determined by non-natural forces, i.e. machinery. In assuming invention as conversion, Ricardo II sees that the introduction of machinery will permanently displace labourers, which will increase the supply of unemployed labourers searching for work. This will push wages to a point below subsistence level.

The conclusions of both Ricardo I and Ricardo II on the effects of machinery on workers may appear to be true, given the distinction between invention with and without conversion. However, there is an underlying contradiction in their views on

19 Ibid, 28.

the extent to which economic phenomena, such as wages and profits, are determined by natural forces. This makes it difficult to simultaneously accept both of their views, *without making alterations to the philosophical foundations of Ricardo's theory*. In other words, to accept Meacci's argument that Ricardo I and Ricardo II are both correct is to assume the plausibility of including Chapter 31 in Ricardo's earlier editions of the *Principles*, given the distinction between invention with and without conversion. However, such a proposition is flawed, as Ricardo II's argument undermines the philosophical naturalism that underpins the rest of his theory, and therefore undermines the overall coherence of his theory.

In conclusion, by adding the chapter on mechanization, Ricardo undermined the philosophical naturalism that grounds the rest of his theory. While he argues that economic phenomena, such as wages and profits, are determined by natural laws in his *Principles*, in Chapter 31 he redirects his thinking and argues that they are instead determined by machinery, a non-natural force. Moreover, his revised theory illustrates that unhindered natural laws do not necessarily result in social harmony. Therefore, his theory of mechanization undermines his attachment to both the objective and subjective elements of philosophical naturalism. Meacci's observation that inconsistency in the theory also lies in the assumptions on which Ricardo I and Ricardo II operate. While this is true, it is not possible to accept Meacci's argument that the views of both Ricardos are correct, as they operate on fundamentally different philosophical beliefs on the determinants of economic phenomena.

Promoting Green Power

AN EMPIRICAL EXAMINATION OF RENEWABLE ELECTRICITY TRENDS IN BC

Dawson McLean

INTRODUCTION

Canada has long been a world leader in renewable electricity production; in 2010, approximately 59% of national generating capacity came from hydroelectric power alone.[1] This is not to say that there is no room for future improvement, as there are policy tools that could be implemented to help promote the switch to renewable power. This paper aims to determine if the introduction of the 2008 carbon tax has resulted in a measureable substitution from non-renewable to renewable electricity generation and to measure the elasticity of supply of renewable and non-renewable energy in BC between 2009 and 2015. To do so, this paper will analyze time series data on electricity generation from Statistics Canada's Canadian Socioeconomic Information Management (CANSIM) database using econometric models estimated by ordinary least squares (OLS) estimators. Section 1 of this paper consists of a short literature review of the considerable research done to this point. Section 2 will introduce the dataset and discuss some of its limitations, while Section 3 will introduce the model and run the empirical tests. It will ultimately

1 Natural Resources Canada. "About Renewable Energy." nrcan.gc.ca, last modified November 26, 2015. Accessed November 29, 2015. http://www.nrcan.gc.ca/energy/renewable-electricity/7295

be determined that, due to hydroelectric supply constraints, the carbon tax has had a limited impact on renewable electricity generation in BC, but there is evidence for a decrease in non-renewable generation, the estimated elasticity of which is -0.087. Overall, the data suggests that the carbon tax has been successful at making electricity in BC less reliant on dirty fuels, but has had little impact in promoting new sources of renewable power.

I. LITERATURE REVIEW

The field of energy economics is currently a very active area of research, and much has been written on the effectiveness of carbon pricing policies. Nordhaus (1993) wrote extensively on the subject, using computer models and simulations to estimate that a carbon tax of $40/tonne carbon rising to $500/tonne by 2100 would change behaviour and reduce emissions enough to stabilize the Earth's climate. More recent analyses of the effectiveness of carbon control policies, using real world data, have had mixed results. Lin and Xuehui (2011) used a difference-in-difference approach to estimate the effectiveness of reducing carbon emissions, using carbon taxes implemented in European countries. Their results were not totally conclusive, but overall, the introduction of the carbon tax is correlated with some reduction in carbon emissions. However, the results from Levin, Thomas and Lee (2010) indicate that carbon taxes and renewable portfolio standards have had very little positive effect on encouraging renewable power in the US state of Georgia. They find that carbon pricing policies stimulated a shift of fuel source from coal to natural gas, but provided few incentives for producers of wind, hydro, solar or other renewable sources to either enter the market or increase production levels. Johnson (2011) uses the existence of a renewable portfolio standard in some US states as an instrumental variable in a two-stage regression to estimate, first, the implicit price of carbon in the economy and, then, the supply elasticity of renewable power in northeastern states. His final elasticity estimate is 2.7, indicating a positive and very strong relationship. Aspergis and

Payne (2010, 2012, 2014) use time series and panel data techniques to measure renewable energy dynamics with respect to other macroeconomic variables. They conclude there is a significant positive relationship with GDP per capita, carbon emissions and real oil prices. Sadorsky (2009) confirms that the same positive relationship also holds in emerging countries. Overall, the lack of definitive evidence of a relationship between carbon pricing and renewable electricity in the literature indicates a high level of complexity in what determines a region's level of renewable electricity generation. Thus, in this research, it will be necessary to have multiple checks for robustness in the results in order to make any meaningful interpretation. In addition, assuming that the relationships found by Aspergis and Payne (2014) and Sadorsky (2009) hold in the case of BC, the significant explanatory variables from their research will be applied here, as well.

II. THE DATA AND MODEL

The primary source of data for this paper consists of electricity statistics from Statistics Canada's CANSIM database. The data consists of monthly observations of the total electricity generation in megawatt-hours (MWh) in BC, broken down into classes such as hydraulic turbine, conventional steam turbine, internal combustion turbine, combustion turbine and others. The dataset spans the period from January 2008 to July 2015, so 91 observations are available. I omitted the first six of these observations because the level of the carbon tax for the first six months of 2008 was zero, leaving 85 observations for the estimation process. Data on other control variables deemed significant by previous research also come from the CANSIM database. As a measure of the price of non-renewable fuels, I have included data gathered from the Bank of Canada on the Canadian Commodity Price Index. I chose this measurement rather than the price of crude oil because it measures the basket price of a variety of fuels including natural gas and coal, which are much more relevant to the generation of electricity.

Data on the BC carbon tax comes from the BC provincial government. The tax was introduced in July 2008 at $10/tonne of carbon dioxide emitted and applied across the board to all products or industrial processes resulting in carbon emissions. The tax is designed to be revenue neutral, thus, the rise in the carbon tax was accompanied by a fall in personal and corporate income taxes, maximizing its effectiveness at shifting behaviour. It rose by $5/tonne every July 1st until 2012, when it reached its maximum value of $30/tonne. Considering that the time period for the analysis spans seven years from 2008 to 2015, the level of the carbon tax at any given time will be deflated to real dollars. Using Consumer Price Index (CPI) data from Statistics Canada, the carbon tax level is deflated to real 2002 dollars by dividing the nominal tax level by the CPI index in the given time period.

The dataset has several drawbacks that may affect the analytical conclusions. For instance, the inclusion of an "Other types of generation capacity" category may have obscured some of the dynamics in the renewable energy data. Some significant renewable energy sources, such as biomass, geothermal and wind, that do exist in BC, do not show up as separate categories in the data, so are likely included within the "Other" category. Despite the fact that there may be some renewable energy sources within this category, it is not possible to consider it as strictly renewable generation capacity since it is vaguely defined. The final results may therefore be slightly biased towards zero, given that some energy dynamics are hidden in the "Other" category. Another potential problem is that the population and GDP data do not match the monthly frequency of the electricity data, given that population numbers are reported quarterly and GDP numbers are reported annually, possibly biasing the final results. These drawbacks should be taken into consideration when determining if causality of the estimated coefficients is an appropriate interpretation.

In returning to the primary electricity data, if we let non-renewable generation in each period be equal to $Q_{N,t}$ and renewable generation be equal to $Q_{R,t}$ then a value yielding the percentage of total generation that is considered to be renewable (in this case

hydroelectric) in each period can be computed as $REG_t = Q_{R,t} /(Q_{R,t} + Q_{N,t})$. Standard microeconomic theory predicts that as the carbon tax rises, firms that produce electricity with non-renewable fuels should reduce their output. As a result, regardless of whether the tax stimulates a rise in $Q_{R,t}$ or not, the overall effect is unambiguously that REG_t should increase, so this could be one interesting variable to be examined. Indeed, a simple plot of REG_t on the real BC carbon tax level indicates that there is some evidence for a positive correlation between the two:

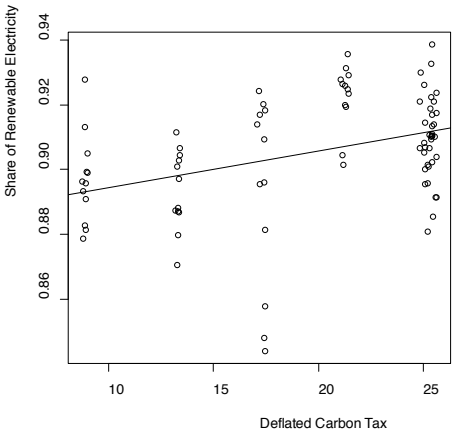


FIGURE 1: Correlation of the BC Carbon Tax and Renewable Power Generation

However, performing an Augmented Dickey Fuller (ADF) test on both REGt and the deflated carbon tax time series (see Appendix 1) indicates evidence for non-stationarity in both series, and thus, using these series in a linear regression model could result in the spurious regression problem described by Granger and Newbold (1974). Indeed, performing an Engel Granger test for cointegration between these two series yields no evidence of any long-run relationship (see Appendix 1). It is possible that REGt , being the quotient of two time series variables, hides many of the trends of interest among the randomness of the two variables and thus, examining $Q_{R,t}$ and $Q_{N,t}$ independently may be the best way to examine the electricity data. Performing an ADF test on the natural logarithms of both $Q_{R,t}$ and $Q_{N,t}$ yields the following results:

TABLE 1
ADF TEST STATISTICS

Series	Test Statistic
$lnQ_{R,t}$	−3.63
$lnQ_{N,t}$	−5.15

Using a critical value at 5% of -2.86, it is clear that there is evidence to reject non-stationary in both series. Running two linear regressions with $lnQ_{R,t}$ and $lnQ_{N,t}$ as explained variables, should therefore allow us to have much more confidence in any possible significant t statistics. The two models are given below:

Model 1

$$\ln Q_{R,t} = \beta_0 + \beta_1 \ln Energy\ Price_t + \beta_2 \ln pop_t + \beta_3 \ln GDP_t + \beta_4 \ln carbon\ tax_t + \beta_5 \ln carbon\ tax_t^{\,2} + \beta_9 t$$

Model 2

$$\ln Q_{N,t} = \beta_0 + \beta_1 \ln Energy\ Price_t + \beta_2 \ln pop_t + \beta_3 \ln GDP_t + \beta_4 \ln carbon\ tax_t + \beta_5 \ln carbon\ tax_t^{\,2} + \beta_9 t$$

These models are estimated where $Q_{R,t}$ is the quantity of renewable generation at time t, $Q_{N,t}$ is the quantity of non-renewable generation at time t, $Energy\ Price_t$ is the level of the Canadian commodity price index at time t, pop_t is the population of BC at time t, GDP_t is the GDP of BC time t, and $carbon\ tax_t$ is the real 2002 dollar level of the BC carbon tax at time t.

III. EMPIRICAL RESULTS AND INTERPRETATION

Three variations of each model are estimated to check for robustness in controlling for population, GDP, time, non-renewable fuel price and the quadratic term. Including the quadratic term in the model should help to control for any non-linear effects

of the carbon tax, and, given that the data is indexed by time, it is also important to include the time variable as a control for a time trend. Using OLS estimators with heteroscedasticity robust standard errors yields the estimated coefficients in the following table:

TABLE II
MODEL 1 COEFFICIENTS

Independent Variables	(1)	(2)	(3)
ln(Energy Price)	–	−0.18 (0.11)*	−0.16 (0.11)
ln(pop)	–	−4.71 (9.86)	1.096 (10.969)
ln(GDP)	–	2.99 (3.26)	3.051 (3.31)
t	–	−0.0072 (0.0110)	−0.013 (0.012)
ln(carbon tax)	0.0027 (0.0025)	0.026 (0.0079)**	0.0040 (0.027)
ln(carbon tax²)	–	–	0.00067 (0.00070)
Intercept	15.32 (0.053)**	11.35 (180.64)	−79.02 (202.26)
Adj. R^2	−0.00048	0.052	0.048
Observations	85	85	85

*NOTES: ** indicates a p-value < 0.05 and * indicates a p-value < 0.1.*

The coefficient on *carbon tax* is positive and insignificant in Column 1, but positive and significant in Column 2. This significance then disappears with the inclusion of the quadratic carbon tax term in Column 3. In the final iteration of Model 2, it appears that there is little evidence of any measureable relationship between $lnQ_{R,t}$ and any of the explanatory variables, running counter to the findings of Aspergis and Payne (2014). The data indicates that the determination of how much renewable electricity is generated in BC is given by variables exogenous to Model

1, and therefore, the quantity of renewable power generated is somewhat fixed over time. In light of this supply rigidity, there is little empirical evidence that the carbon tax has spurred any growth in renewable electricity capacity. To measure the effect of the carbon tax on the non-renewable electricity sector, we estimate the coefficients in Model 2 as:

TABLE III
MODEL 2 COEFFICIENTS

Independent Variables	(1)	(2)	(3)
ln(Energy Price)	–	−0.093 (0.12)	−0.019 (0.10)
ln(pop)	–	28.26 (9.41)**	51.63 (10.14)**
ln(GDP)	–	3.11 (3.42)	3.38 (3.31)
t	–	−0.031 (0.012)**	−0.053 (0.012)**
ln(carbon tax)	−0.010 (0.0033)**	−0.0025 (0.0110)	−0.093 (0.030)**
ln(carbon tax²)	–	–	0.0027 (0.00084)**
Intercept	13.30 (0.07)**	−498.46 (186.45)**	−862.38 (182.74)**
Adj. R^2	0.17	0.17	0.16
Observations	85	85	85

*NOTES: ** indicates a p-value < 0.05 and * indicates a p-value < 0.1*

The first iteration of Model 2 indicates a negative and significant coefficient on *carbon tax*, which becomes insignificant after controlling for non-renewable fuel price, population and GDP, but significant again when the quadratic term is considered. The third iteration of Model 2 also shows a negative and significant relationship with *carbon tax* and a positive and significant relationship with *carbon tax²*, suggesting the negative effect of *carbon tax* becomes less negative the higher the carbon tax

rises. The coefficients on non-renewable fuel price and GDP are estimated to be insignificantly different from zero, also running counter to the findings in Aspergis and Payne (2014). At the same time, however, the coefficients on population and time appear significant, and the highly positive coefficient on population is of particular interest. Table 3 indicates that as population rises by 1%, non-renewable generation will rise by 51.6%. Holding GDP fixed, we would expect that as population rises, GDP per capita falls and non-renewable generation rises. As a result, we would expect to see a negative relationship between GDP per capita and non-renewable generation that is driven more by a relationship between population and non-renewable generation rather than GDP and non-renewable generation, similar to the findings of Aspergis and Payne (2014). Overall, however, there is evidence for a negative relationship between the carbon tax and non-renewable electricity generation in BC. These findings suggest that the BC carbon tax is indeed associated with a rise in the percentage of renewable electricity generation, which is driven more by a reduction in non-renewable generation capacity rather than an increase in renewable capacity. Since there is no evidence to reject non-stationarity in the electricity data for either Model 1 or 2, we can have confidence that these results are not the product of a spurious regression. To completely rule out this possibility, however, an Engel Granger test on Model 2 and 3 yields evidence of co-integration and, thus, long-run relationships, for both models (see Appendix 2).

Since both models have logarithms on both sides of the equation, the coefficients on the carbon tax variables can be interpreted as a measure of the elasticity of renewable and non-renewable power with respect to the carbon tax. Taking the derivatives of Model 2 and 3, with respective to *carbon tax*, yields the elasticity estimator below, where i is an index of Model 1 and Model 2, respectively:

$$\widehat{Elasticity}_i = \hat{\beta}_{4,i} + 2\hat{\beta}_{5,i}$$

Since the elasticity estimator is a linear combination of coefficients, its standard error (s.e.) estimates are defined by the following equation, where $var(\bullet)$ is a measure of variance and $cov(\bullet)$ is a measure of covariance.

$$\widehat{s.e.}(\widehat{Elasticity}_i) = \sqrt{\widehat{var}(\hat{\beta}_{4,i}) + 4\widehat{var}(\hat{\beta}_{5,i}) + 2\widehat{cov}(\hat{\beta}_{4,i}, \hat{\beta}_{5,i})}$$

The estimates and standard errors are summarized below:

TABLE IV
ELASTICITY ESTIMATES

Model	Results
Model 1	0.0053 (0.028)
Model 2	−0.087 (0.029)**

*NOTES: ** indicates a p-value < 0.05 and * indicates a p-value < 0.1*

As expected, the elasticity estimate for Model 1 is insignificantly different from zero, and the elasticity estimate for Model 2 is negative and significant. Thus, a rise of 1% of the BC carbon tax is associated with no change in the quantity of renewable power supplied, but a decrease of 0.09% in non-renewable power.

A plausible factor explaining the measured supply rigidity of renewable power is simply that the vast majority of electricity in BC comes from hydroelectric dams. Hydro power producers are supply constrained considering that the quantity of moving water required to generate electricity is determined by natural forces. Thus, hydroelectric producers have a limited capacity to increase generation, unlike the case of a power plant fuelled by coal or natural gas. In addition, dams require enormous capital and infrastructure investment to build, and, so, increases in hydroelectric capacity occur over the very long run. This explains why GDP, non-renewable fuel prices and the carbon tax have such a limited explanatory impact on renewable generation capacity

in Model 1. Since hydroelectric power supply can be assumed to be fixed, dams across the province will produce essentially the same amount of power regardless of GDP, other fuel prices or the level of the carbon tax. Thus, a regression of the quantity of renewable electricity on any of these explanatory variables should yield no statistically significant results, which is exactly what is observed. Hydro supply constraints also offer some insight into why the coefficient on population in Model 2 is so positive. When the population of the province rises, it raises the demand for electricity and places pressure on the electricity grid. Since hydro power cannot increase supply to meet demand, the increase in generation capacity must come from other power sources that can more easily and quickly increase supply, namely natural gas-fired plants. Model 2 suggests that an increase in population by 1% results in an increase of 51.63% in non-renewable generation, so this hypothesis seems to match the data.

An important question to reflect on is whether the coefficient and elasticity estimates reflect causality. If the above estimates reflect a causal relationship, then we can reliably determine the level of tax required to raise renewable generation or suppress non-renewable generation to some desired level. Unfortunately, however, an interpretation of causality in this case is likely not appropriate. An electric company's decision to generate electricity using renewable fuels is a complex process, and, as such, it is likely that there is omitted variable bias in the model. For example, one factor that has not been controlled for in this research is the fact that BC Hydro is a vertically integrated company responsible for all aspects of electricity generation and distribution. It is likely that BC Hydro would respond differently to the carbon tax if it were a privately owned generator selling to a provincial grid. In order for Models 1 and 2 to reliably estimate the supply response to an exogenous increase in the price of carbon, it must be assumed that generators unilaterally make supply decisions when faced with changes in the market price for their products. A violation of this assumption, as may be the case with BC, introduces some endogeneity issues into the interpretation. In addition, I have made the assumption that the electricity market

in BC is closed to the export of power and it is possible that the coefficients estimated in Tables 5 and 6 could change if we relax this assumption. Exactly how and by how much the coefficients would change is difficult to determine without further research.

Problems with the data also preclude us from concluding the coefficients in Tables 2 and 3 represent a causal relationship. From Section 2, the dataset from Statistics Canada includes an "Other types of electricity generation" category which I have not included in $Q_{R,t}$, possibly biasing the results towards zero. The frequency mismatch in the data is also problematic in that we likely lose some dynamics in the model when renewable power data changes but the quarterly data is observed to be unchanged. However, the fact that the resulting coefficient from Model 2 is still significantly negative, in spite of factors biasing it towards zero, gives us additional confidence in the measured negative relationship between the carbon tax and non-renewable power generation.

CONCLUSION

This paper attempts to measure the supply elasticity of renewable and non-renewable electricity generation in BC and determine how the introduction of the BC carbon tax in 2008 has affected renewable and non-renewable electricity generation in the province. Overall, estimating Models 1 and 2 indicates that the level of electricity generated in BC from renewable sources is not influenced by any of the explanatory variables. Non-renewable power, however, does appear to be affected by population, time and the carbon tax. The best estimates of renewable and non-renewable electricity elasticities obtained are 0.0053 and -0.087, respectively, where the estimate for renewable power is not statistically significant. Therefore, there is evidence for a rise in the percentage of total generation that is renewable, here defined as REG_t, with respect to the carbon tax, but it is driven almost entirely by a reduction in non-renewable generation rather than growth in renewable generation. It is possible that these

results reflect the fact that the vast majority of electricity in BC is generated with hydroelectric dams, which are supply constrained as their output is determined by natural forces. Unfortunately, these estimates are likely not reflective of a causal relationship, due to issues with the data that bias the results, such as the inclusion of a vague "Other" category in the dataset, and the mismatch of data frequency between the electricity statistics and other explanatory variables. The results seem to indicate that the carbon tax has had a fairly limited impact in promoting renewable electricity generation in BC. That is not to say that the carbon tax is an ineffective policy tool, as there is a significant amount of evidence that it has had major positive effects in reducing carbon emissions from other sectors of the economy. Further research could examine the relationship between the carbon tax and new, non-traditional sources of renewable power or investment in renewable energy. This approach would remove the largely static effects of hydroelectric generation on renewable power in BC and, thus, could lead us much closer to estimating the true causal effect of carbon pricing on stimulating renewable electricity generation.

Women's Autonomy in Red India

ASSESSING THE C.P.M. IN POWER

Roshak Momtahen

There is a growing understanding that international development goals are contingent on the removal of gender inequalities. Policy statements ranging from the Beijing Platform for Action and Cairo Programme of Action to the Millennium Declaration all stress the importance of women's empowerment. Gender equality is clearly a paramount objective for development efforts. In addition, gender equality serves as a means to promote better governance, reduce poverty and promote growth (Gupta and Yesudian 2006). Women's empowerment, defined by Kabeer (2001) as "the expansion in one's ability to make strategic life choices in a context where this ability was previously denied," is the central measure of this study.

Women's empowerment is contingent on gender issues. Different roles and responsibilities are often gendered and thus solely assigned on the basis of an individual's identity. The level of empowerment for a woman in society is a function of the ways that "gender identities, gender roles and gender relations are conceived at the family, household, community and societal levels" (Gupta and Yesudian 2006). In India, like many places around the world, roles assigned to women are valued less than roles assigned to men (Malholtra et al. 2002). Measures of women's empowerment seek to analyze the degree to which this inequality

has been overcome in a society.

The focus of this paper is the relationship between governance by the Communist Party of India, Marxist (CPM or CPIM), and women's empowerment in India. Formed from a split with the historical Communist Party of India in 1964, the CPM today is the largest leftist party in India. Although active throughout the country, the party's strength is concentrated in the states of Tripura, West Bengal and Kerala. Henceforth, these three states will be referred to as 'CPM states'. Among national Indian political parties, the CPM stands out with regards to gender inequality. Their programme states:

> With India's independence the women of India, equal participants in the freedom struggle, had hoped for emancipation from the shackles of centuries old feudal and gender oppression. But leave alone advance, five decades of bourgeois-landlord rule have perpetuated patriarchy in every sphere. Women are exploited at different levels, as women, as workers and as citizens. The process of liberalisation has brought in its wake newer forms of gender exploitation, in both the economic and social spheres, leading to increased violence against women. Economic independence and an independent role in social and political life are basic conditions for the advance of women. Resistance against this unequal status and the women's movement for equality are part of the movement for social emancipation.[1]

Due to the CPM's programme and the general orientation of leftist politics, it is reasonable to expect the party to emphasize women's empowerment. However, turning a party's goals into policy outcomes is not always straightforward. Occasionally parties are unable or unwilling to implement their desired programs. This paper seeks to assess the effect of party governance on women's empowerment. Specifically, I seek to identify the

1 Communist Party of India (Marxist)

relationship between a state being governed by the CPM and its level of women's empowerment, allowing us to explore the significance of party governance in determining empowerment. The results from such a study can have major effects on development strategies. Although focused on the CPM, this same approach can be expanded to assess the effect of governance by other parties.

DEFINING WOMEN'S EMPOWERMENT

The nebulous definition of 'empowerment' has prevented the development of one standardized metric. Batliwala (1995) uses a particularly comprehensive definition of women's empowerment as: "the process, and the outcome of the process, by which women gain greater control over material and intellectual resources, and challenge the ideology of patriarchy and the gender-based discrimination against women in all the institutions and structures of society."[2] Thus women's empowerment refers to both the material external reality, such as control over resources, and to the internal ideological aspects such as having the ability to recognize patriarchy. As a result, a scholar researching women's empowerment has a wide scope of variables that they could utilize in their analysis, each varying in sophistication and measurement abilities. For example, Acha (2014) simply uses the gap in average education levels between men and women as the outcome variable for measuring empowerment. In contrast, Gupta and Yesudian (2006) construct multiple indices with each measuring a different aspect of empowerment using data from India's Demographic Health Survey (DHS). The former method is blunt and unsophisticated, however, unlike the latter method, can be replicated in any country. Researchers also have different ways of constructing these indices. For example, Head et al. (2015) use a woman's

2 Srilata Batliwala, "Defining women's empowerment: A conceptual framework," *In Education for Women's Empowerment*, Position Paper for the Fourth World Conference on Women, Beijing, New Delhi: ASPBAE, (1995): 7-8.

"customary resources for exercising influence"[3] while Gupta and Yesudian (2006) do not. As this paper assesses regional differences in women's empowerment, it is important to note that earlier studies suggest that empowerment is higher in southern India, where the CPM state of Kerala is located (Malholtra et al. 1995).

DATA & METHODOLOGY

Data: This study is based on data from the 2006 National Family Health Survey in India (NFHS-3), conducted by the International Institute for Population Sciences (IIPS). Field surveyors in each of India's states collected the surveys.

Analysis: Data analysis was done by using Stata 12. Our analysis uses three different outcomes variables. Two are ordered logit functions while the third is a logistic regression. The three outcome variables measure three different metrics of women's empowerment. Included within the regressions are the variable of interest, governance by the CPM and a selection of other relevant control variables.

Outcome Variables: The approach taken here is a more sophisticated method of measuring empowerment, following the Gupta and Yesudian (2006) approach. I utilize three different indices that measure women's empowerment: household autonomy, freedom of mobility and attitudes towards domestic violence. As mentioned in the introduction, empowerment is a multifaceted and complex phenomenon. Rather than arbitrarily force dissimilar outcomes into one 'score' for empowerment, I focus on three specific aspects of empowerment individually.

Household Autonomy Index: This index measures the degree to which a woman is independent to make both household and personal decisions. In NFHS-3, women were surveyed about decision-making in their household. Our index is constructed from variables v743a to v743f, each measuring various survey responses

3 Sara K. Head, Kathryn M. Yount, Monique M. Hennink and Claire E. Sterk, "Customary and contemporary resources for women's empowerment in Bangladesh," *Development in Practice* 25(3) (2015): 363.

indicating whether or not the respondent participates in decisions regarding her healthcare, household finances and visits to friends or family. There are a total of five such questions and the index assigns a score ranging from zero-to-five depending on the number of decisions that the woman participates in. The previous five binary results for each respondent were added to create a new variable for the autonomy index. A higher score is reflective of greater household autonomy.

Freedom of Mobility Index: This index assigns a discrete score ranging from zero to three for each respondent. It was constructed using variables s824 a,b,c. These variables are the women's responses to questions about whether or not they are allowed to the market, to health centres or to places beyond their community on their own. A new binary variable was assigned to each of the previous variables, equaling 1 when the respondent is able to travel alone. The mobility index variable is the sum of these three binary outcomes for each respondent. Similar to the last index, a higher score reflects greater freedom of mobility.

Attitudes towards Domestic Violence: The last outcome variable seeks to measure the intrinsic and ideological aspect of women's empowerment. Constructed on variables s829f, g and v744a-v44d, it assesses whether the respondent justifies domestic violence in a variety of situations. The outcome variable was created by taking the maximum of the seven binary variables. This outcome variable differs from the previous indexes in two ways. Firstly, it assigns a score of 1 to a respondent that justifies DV in any one or more of the alternative situations. Thus, a woman who justifies domestic violence in 1/7 situations is assigned the same score as a woman that justifies domestic violence in 7/7 situations. Secondly, unlike the other indexes, a smaller outcome signals greater women's empowerment. Thus, determinants are positively correlated with women's empowerment if their odds ratios are less than one in the regression.

Independent Variables: In order to control for other factors, the regressions include multiple other relevant factors that may determine women's empowerment, beyond the explanatory political variable. See Table I.

TABLE I

Independent Variable	Data	Description
cpim	Added to NFHS-3	Binary variable that equals one for the states historically dominated by the CPM: Tripura, West Bengal, and Kerala. This is the independent variable of interest.
gdps	Added to NFHS-3	Measures GDP per capita by state. Was added manually to the dataset using information from the Press Information Bureau. This variable is discrete, there are 32 different data points each corresponding to one state. This seeks to control for the effect of economic development on women's empowerment. This is important for our analysis as it is reasonable to assume that the CPM is more popular in poorer states.
Highest EduLevel	v106	A discrete measure of the respondent's education, ranging from 0 (no education) to 3 (higher education).
Wealthy	v190	Constructed from a discrete measure of the respondent's wealth level, ranging from 1 (poorest) to 5 (richest). Wealthy is a binary variable that equals 1 when the respondent's wealth level is 4 or 5 (wealthy or wealthiest).
Currently Working	v714	A binary variable equaling one if the respondent is currently employed.
Tribe	s117	A constructed binary variable that equals one when the respondent identifies with a tribe.
Age	v012	The respondent's age at the time of NFHS-3
Urban	v102	Constructed using v102, this is a binary variable equaling one when the respondent lives in a city.
Hindu	v130	A constructed binary variable equaling one when the respondent identifies as Hindu.
Muslim	v130	A constructed binary variable equaling one when the respondent identifies as Muslim.
Christian	v130	A constructed binary variable equaling one when the respondent identifies as Christian.

Overall, these independent variables were selected to control for other factors that are thought to affect women's empowerment. This allows us to better specify what effect CPM governance is having on the issue. For example, it is likely the case that the CPM does better in poorer states. If poorer communities have a smaller degree of women's empowerment, then we may falsely associate the CPM with causing this lower level of empowerment.

Regressions: I utilize three different regression functions, one for each outcome variable. An ordered logit function is used for the first two regressions as their outcome variables are ordered and discrete (with a higher score indicating greater autonomy or mobility). A logistic regression is used for the last function as its outcome variable is a binary outcome.

(1) $Autonomy\ Index\ =$
$f(CPM, gpds, highest\ education\ level, wealthy, currently\ working, age, tribe, urban, Hindu, Muslim, Christian)$

(2) $Mobility\ Index\ =$
$f(CPM, gpds, highest\ education\ level, wealthy, currently\ working, age, tribe, urban, Hindu, Muslim, Christian)$

(3) $Attitudes\ Towards\ DV\ =$
$f(CPM, gpds, highest\ education\ level, wealthy, currently\ working, age, tribe, urban, Hindu, Muslim, Christian)$

RESULTS

The results in Table II are generated from data from *all* Indian states. This approach is somewhat limited for two reasons. Firstly, there are significant regional differences between Indian states. Secondly, the CPM states vary greatly in size. Any unique peculiarities of West Bengal, the largest CPM state by far, may cloud the relationship that CPM governance may have in Kerala and Tripura. Fortunately, for our analysis, each CPM state is located in a unique regional area: Kerala in South India, West Bengal in East India and Tripura in Northeast India. See Table III. The three regressions were repeated for each region, totaling to nine regressions. Due to space limitations, I have opted to include only the coefficients and odds ratios of CPM governance on our outcome variables. The full results can be provided on request.

TABLE II

All-India	Ordered Logit		Logistic
	Household Autonomy	Freedom of Mobility	Attitudes towards DV
	(N=124110)		
Explanatory Variables	Coefficient (Std. Error) [P-Value]		Odds Ratio (Std. Error) [P-Value]
CPM	−0.245 (.018) [0]**	−0.0732 (.019) [0]**	0.766 (.015) [0]**
gdps	5.74e−07 (1.40e−07) [0]**	4.10e−06 (1.42e−07) [0]**	1.00 (1.55e−07) [0]**
HighestEduLevel	−0.053 (.006) [0]**	0.253 (.007) [0]**	0.777 (.005) [0]**
Wealthy	−0.115 (.014) [0]**	0.191 (.014) [0]**	0.757 (.012) [0]**
CurrentlyWorking	−0.229 (.012) [0]**	0.543 (.012) [0]**	1.11 (.014) [0]**
Age	0.098 (.001) [0]**	0 .069 (.001) [0]**	0.993 (.001) [0]**
tribe	0.144 (.020) [0]**	0.05 (.021) [0.02]*	1.199 (0.28) [0]**
urban	0.164 (.013) [0]**	0.393 (.013) [0]**	0.69 (.009) [0]**
Hindu	−0.023 (.024) [0.345]	−0.299 (.025) [0]**	0.796 (0.21) [0]**
Muslim	−0.196 (.028) [0]**	−0.582 (.029) [0]**	1.013 (.032) [.669]
Christian	0.119 (.031) [0]**	−0.112 (.031) [0.72]	1.77 (.062) [0]**

** significant at 1%. *significant at 5%

TABLE III
COEFFICIENTS & ODDS RATIOS FOR CPM GOVERNANCE

	Coefficient (Std. Deviation) [P-value]		Odds Ratio (Std. Dev.) [P-value]
	Household Autonomy	Freedom of Mobility	Attitudes towards DV
South India (includes Kerala) N=22584	0.0216	−0.324	1.252
	(.038)	(.039)	(0.056)
	[0.564]	[0]**	[0]**
East India (includes W. Bengal) N=18107	−0.357	1.241	0.380
	(0.053)	(.059)	(.023)
	[0]**	[0]**	[0]**
Northeast India (includes Tripura) N=21786	−0.722	−0.369	0.499
	(0.049)	(0.049)	(0.026)
	[0]**	[0]**	[0]**

** significant at 1%. *significant at 5%

In the all-India results, I find that being governed by the CPM has mixed effects on women's empowerment. It is correlated with a significant reduction in household autonomy and freedom mobility. On the other hand, it is significantly correlated with a major reduction in the likelihood of a woman rejecting domestic violence. The results reiterate the importance of having different metrics for women's empowerment. Depending on the outcome variable, CPM governance may be associated with an increase or decrease in empowerment.

At the more detailed regional level of analysis, we again find mixed results. However, upon combining the three regional regressions for each outcome variable with the all-India regression (for a total of 12 regressions) a clear pattern emerges. CPM governance is correlated with a *reduction* in household autonomy in three out of four cases, with the one exception of South India providing an insignificant result. With regards to mobility, CPM governance is correlated with a *reduction* in three out of four cases, with a positive result in East India being the exception. With regards to attitudes towards DV, CPM governance is correlated with an *increase* in women rejecting domestic violence. Of our three outcome variables, the attitudes towards domestic

violence is the only one pertaining to the ideological and non-material aspect of women's empowerment. Thus, the results show that CPM governance is correlated with *lower* levels of women empowerment with regards to the material and physical aspects, such as freedom of mobility and control over household resources. Our results also show that CPM governance is correlated with *greater* women's empowerment with regards to the intellectual and ideological aspects of empowerment; such as a woman's likelihood of recognizing domestic violence as unacceptable in any situation.

DISCUSSION

The results show that the CPM is negatively correlated with household autonomy and mobility, in contrast to its positive association with women's attitudes towards domestic violence. What might explain these findings? One explanation is that the CPM has been more successful in expanding educational opportunities for women than actually expanding women's empowerment in their households, which our first two outcomes variables measure. This is a very plausible situation as a state's policies have very direct effects on women's education while the effects of state policy on a woman's relative power in her household is less clear. Indeed, the data shows that the CPM binary variable is correlated with higher levels of education in women. Overall, the results show that the CPM may have mixed effects on women's empowerment, depending on the outcome variable examined.

Due to the CPM's programme and the general orientation of leftist politics, it is reasonable to expect that, ceteris paribus, governance by the CPM will increase women's empowerment. However, our results show the relationship is nuanced; simply electing a party in favour of women's empowerment has had indeterminate effects on actual women's empowerment. The analysis includes several relevant control variables in order to establish this 'ceteris paribus' condition. All except a few of the religion variables are significant at the all-India level. Several of the control variables become insignificant at the regional level.

Overall, the regressions comprehensively control for the level of economic development and demographic factors in each state. The variable of interest, CPM, intends to capture any policy differences between CPM states and other Indian states. However, it is possible that the CPM variable captures other omitted variables affecting empowerment unique to each CPM state. There is also the issue of reverse causality; that states with lower women's empowerment are more likely to vote for the CPM, due to its focus on women's issues. If we reverse the causality in our results, we see that states where women have lower levels of physical empowerment but higher level of intellectual empowerment are more likely to be governed by the CPM. The very plausible narrative here is that women who experience lower empowerment physically and intellectually recognize this as a problem will seek change by voting for the CPM. Indeed, the historical evidence shows that women have been more likely than men to vote for the CPM (Deshpande 2009).

Another interesting aspect of the results is in regard to the performance gap between the CPM in Kerala and West Bengal. The CPM in West Bengal is often maligned due to its failure to accomplish the high socioeconomic outcomes that its comrade party in Kerala has been able to achieve (Desai 2001). However, our results show that Kerala underperforms in women's empowerment when compared to other South Indian states. In contrast, West Bengal outperforms other East Indian states. We also find that higher wealth levels are correlated with lower empowerment in the majority of the regressions. This is consistent with other studies that women from wealthier backgrounds are held to stricter patriarchal standards (Chakrabarti and Biswas 2012).

FUTURE RESEARCH

This study serves as a strong first step in assessing the effect of party governance on empowerment. These results would be strengthened by the addition of NFHS data from other years. It may be that women's empowerment in CPM states has increased

at a different rate than the rest of India—a major implication when assessing the party's performance. The results from the analysis of the 2006 survey data provide only a snapshot of the CPM's role at one point in time—it does not capture the party's success or failure in empowering women over the forty years the CPM has dominated politics in Kerala, West Bengal and Tripura. In addition, the analysis would be strengthened by differentiating between the years of CPM rule in each of the three states, as opposed to the current method of joining them together as uniform 'CPM states'. This analysis can also be expanded to incorporate other Indian parties. Thus, new variables would be constructed to measure the number of years a party has governed each state. Lastly, another relevant factor is a state's alcohol policy. Both Kerala and West Bengal have nationalized the production and sale of alcoholic beverages. This may lead to state governments having disincentives to combatting high alcohol consumption, which is usually correlated with lower socioeconomic outcomes for women. If CPM states are more likely to rely on nationalized alcohol revenues, then this may be the mechanism whereby CPM rule is causing lower women's empowerment. This hypothesis should be tested in future analysis.

CONCLUSION

The findings in this study show that CPM governance has significant effects on women's empowerment. At the All-India level, governance by the CPM is associated with lower household autonomy, lower freedom of mobility and a higher likelihood of women rejecting domestic violence. Combined with our results at the regional level, totaling twelve regressions, the CPM is associated with lower physical aspects of empowerment (household autonomy & mobility) but higher intellectual empowerment (rejection of domestic violence). I identify two plausible mechanisms for this surprising result. Firstly, the CPM may have been successful in increasing education levels for women but unsuccessful in increasing women's relative power in their households.

Secondly, there may be reverse causality where women with higher intellectual empowerment and lower physical empowerment are voting CPM as a deliberate strategy for overcoming their lack of physical empowerment. Both mechanisms are supported by the evidence and further research is needed to confirm these mechanisms and to specify which effect is dominant.

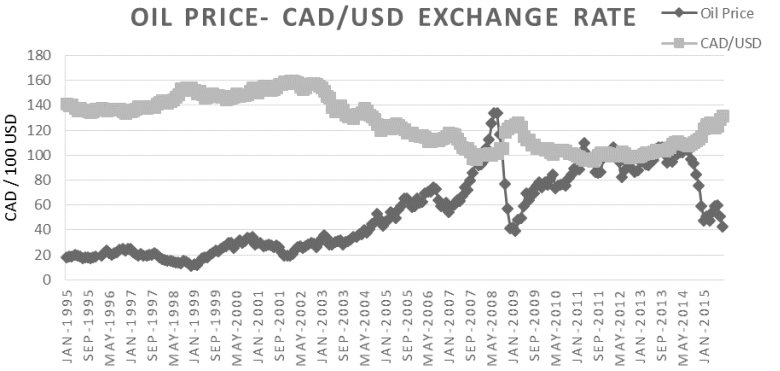
Oil Price Fluctuations and Canada's Exchange Rates

Dongxiao Zhang

I. INTRODUCTION

Oil occupies a unique position in the economy. Significant fluctuations in oil prices have been detrimental to the real economy with inflationary and unemployment effect (Gisser and Goodwin 1986). When oil prices increase, oil importing countries suffer from a price surge. Conversely, a drastic fall in the price of crude oil results in lower economic growth, worse employment outcomes and currency depreciation of oil exporting countries. Canada is the world's sixth largest oil producer, exporting 73% of domestically produced crude oil in 2013. So it is reasonable to think oil price shocks can be transmitted to Canada's real economy, noticeably, through fluctuations in exchange rates. This co-movement of oil prices and exchange rates can be seen in Figure 1, especially during the 2008 financial crisis. Oil prices fell from 133.37 USD/Barrel to 39.09 USD/Barrel from July 2008 to February 2009 because of weaker industrial demand for oil. A consistent depreciation of the Canadian dollar was reflected by a rise in the exchange rate from 1.01 CAD/USD to 1.24 CAD/USD during the same period. A similar trend can be seen more recently as the Canadian currency plummeted following the fall of oil prices over the last 14 months.

FIGURE 1



Source: nominal exchange rates (CAD/USD) from the Federal Reserve Bank of Saint Louis and spot oil prices from the Energy Information Administration website.

Note: that nominal exchange rates here indicate value of Canadian dollar in in terms of per 100 U.S. Dollars.

It is plausible to hypothesize that extreme fluctuations in oil prices have had a palpable effect on Canada's real exchange rates. The theoretical framework of the connection between the global oil market and the currency market has been established in other studies. The impact of oil price movements on exchange rates was explicated by Krugman (1980): the deprecation of oil-exporting countries' exchange rates occurs when oil prices fall. The role of exchange rates in explaining oil price fluctuations was demonstrated by Bloomberg and Harris (1995). An appreciation in an oil exporter's currency increases oil prices offered to foreign importers in their own currencies. The purchasing power of oil importers is weakened, and a negative effect on foreign oil demand lowers the price level of oil.

This paper examines the relationship between the market price for crude oil and the Canadian exchange rate. Since exchange rates are sensitive to fluctuations in domestic supply and money stock, this study, in particular, analyzes how oil price shocks when coupled with two other underlying macroeconomics shocks—domestic supply and money stock—impact the Canadian exchange rate in the short and long term. The results show that an oil price rise causes an appreciation in the CAD, and this is

the primary contributor to the variation of the exchange rate compared to domestic supply and money stock.

The article is organized as follows. A brief review of the literature on the link between currency and oil markets is presented in the next section. Section 3 describes the theoretical framework and the Structure Vector Autoregressive (SVAR) model constructed for this research. Section 4 refers to the data source and provides some preliminary analysis. The empirical results and limitations are discussed in Section 5, and Section 6 summarizes the main findings and concludes the paper.

II. LITERATURE REVIEW

Existing empirical studies have disagreements on the dependent structure of oil prices and exchange rates. Akram (2004) has suggested that oil prices and Norwegian exchange rates are non-negatively related. Cifarelli and Paladino (2010) reported a negative relationship between oil prices and exchange rates in oil-exporting countries, consistent with Krugman's (1980) previously mentioned findings. Lizardo and Mollick (2010) argued that a significant depreciation of the USD against net oil-exporting countries' currencies can be observed as oil prices increase. These findings were challenged by Reboredo (2012) who demonstrated that an increase in real oil prices is weakly associated with depreciation of the USD. Given this disagreement, this paper will re-examine the dependent structure between oil prices and the real value of Canadian currency.

There exist two main channels in which to analyze the determination of the real exchange rate: factors of the real economy and financial markets. The view based on real factors was formulated under the contributions of Stockman (1980). He contended that changes in exchange rates and deviations from purchasing power parity are caused by disequilibria in the product market, and these changes are induced by shocks from real factors like productivity.

Money supply is also considered an essential factor in

determining the currency value. Dornbusch (1976) demonstrated that a monetary expansion is responsible for the depreciation of real exchange rates if the price adjustment is sluggish. Chen (2004) also found that domestic money supply plays an important role in the variance of exchange rates in the long run.

Others have also introduced exogenous variables, such as real supply, money supply and domestic price level, to the conventional monetary model of the exchange rate to analyze the link between real exchange rates and real oil prices. Lizardo and Mollick (2010) added oil prices to the monetary model and found the movement of USD exchange rate can be explained by fluctuations of oil prices. Using a similar approach, Huang and Guo (2007) argued that oil price shocks induce a minor appreciation of the Chinese currency against China's main trade counterparties in the long run. This sort of extended monetary model has mainly been used to explore how changes in oil prices have influenced the currency value of oil-importing and oil-exporting countries. Based on a brief survey of previous literature, this paper constructs a Vector Autoregressive (VAR) system using the monetary approach.

III. METHODOLOGY

The constructed structure VAR model has four dimensions comprising of real oil prices, real industrial output, real money stock and real exchange rates. Since forecasting real exchange rates can prove challenging due to the uncertainty of the dynamic international currency market, simply considering the interaction only between real exchange rates and real oil prices can hardly reveal the actual determination process of real exchange rates. Thus, taking other underlying macroeconomic factors into account is necessary in this analysis. Before formally introducing the model, the reasons why industrial supply and the money stock are taken into consideration are discussed.

3.1 THEORETICAL FRAMEWORK

Purchasing power parity (PPP) is a useful theory in determining exchange rates. It implies that the long-run equilibrium of exchange rate is decided by the relative purchasing power, i.e. price level, between two countries. It can be indicated as follows:

$$E_{CAD/US} = P_{CAD}/P_{US} \quad (1)$$

where
P_{CAD} = level of average prices in Canada,
P_{US} = level of average prices in U.S.,
$E_{CAD/US}$ = Canadian dollar-U.S. dollar exchange rate.

In the money market, the determination of aggregate money demand can be formulated as follows:

$$M^d = P \times L(r, Y) \quad (2)$$

where
M^d = aggregate demand for money,
P = price level,
r = domestic interest rate,
Y = real GNP (i.e., real domestic supply).

The steady state of exchange rates can be achieved when the money market reaches its equilibrium by satisfying the condition that aggregate money demand is equal to aggregate money supply (i.e., $M^s = M^d$, where M^s = aggregate money supply.).

Considering both PPP and money market equilibria in both countries, the determination of exchange rates can be formulated as follows:

$$E_{CAD/US} = \frac{M^S_{CAD} \times L(r_{US}, Y_{US})}{M^S_{US} \times L(r_{CAD}, Y_{CAD})} \quad (3)$$

Since M^S_{US}, r_{US}, and Y_{US} can be assumed as exogenous terms (determined only by U.S. authorities), in equation (3), Canada's

money supply, domestic interest rate and Canadian real supply (i.e. real GNP) are treated as determinant factors for the value of Canadian currency. Since both Canadian and American currencies have high liquidity, according to the uncovered interest rate parity (UIP), any fluctuations in a country's domestic interest relative to the others will be entirely captured by an expected appreciation or depreciation in the exchange rate, which can be formulated as follows:

$$(4) \qquad f(r_t^{CAD} - r_t^{US}) = \mathbf{E}(E_{CAD/US}^{t+1} - E_{CAD/US}^{t} | \Omega_t) = \mathbf{E}(\Delta E_{CAD/US}^{t+1} | \Omega_t)$$

where Ω_t = the available information set at time t.

If $E_{CAD/US}^{t}$ is integrated to one, which is confirmed by applying unit root test in Section 4, the difference between exchange rates in two continuous periods is only a random shock, which indicates that $\mathbf{E}(\Delta E_{CAD/US}^{t+1} | \Omega_t) = 0$ will hold in the steady state (Rapach and Wohar 2002). Hence, according to UIP, stochastic shocks on interest rates will not impact the expected change in exchange rates in the long run. Thus, Canada's money supply and real supply should be treated as endogenous variables relative to the Canadian exchange rate in the structure VAR model.

3.2 EMPIRICAL MODEL

As mentioned in Section 2, adding the real oil price as an exogenous variable into the exchange rate determination model can be seen as very useful in analyzing the role of oil price shocks on real exchange rates. At this point, I simply hypothesize that all data series are non-stationary and will become stationary after taking the first difference. This hypothesis is examined later in Section 4. Based on the non-stationary series assumption, all variables in this study follow the random walk process, which can be represented as follows:

$$o_t = o_{t-1} + \epsilon_t^o, \quad s_t = s_{t-1} + \epsilon_t^s, \quad m_t = m_{t-1} + \epsilon_t^m, \quad e_t = e_{t-1} + \epsilon_t^e,$$

where
o = real oil price,
s = real supply,
m = domestic money stock,
e = the real exchange rate (CAD/USD),
$\epsilon_t \sim N(0, \sigma_t^2)$ for all t.

So that Δo_t, Δs_t, Δm_t and Δe_t are stationary series and employed to represent corresponding variables in the following structure VAR(p) model:

(5) $$\Delta o_t = \emptyset_o + \sum_{i=1}^{p} \theta_{o,t-i} * \Delta o_{t-i} + \varepsilon_t^o$$

(6) $$\Delta s_t = \emptyset_s + \sum_{i=0}^{p} \left(\alpha_{o,t-i} * \Delta o_{t-i} + \alpha_{m,t-i} * \Delta m_{t-i} + \alpha_{e,t-i} * \Delta e_{t-i}\right) + \sum_{i=1}^{p} \alpha_{s,t-i} * \Delta s_{t-i} + \varepsilon_t^s$$

(7) $$\Delta e_t = \emptyset_s + \sum_{i=0}^{p} \left(\beta_{o,t-i} * \Delta o_{t-i} + \beta_{m,t-i} * \Delta s_{t-i} + \beta_{e,t-i} * \Delta m_{t-i}\right) + \sum_{i=1}^{p} \beta_{e,t-i} * \Delta e_{t-i} + \varepsilon_t^e$$

(8) $$\Delta m_t = \emptyset_s + \sum_{i=0}^{p} \left(\gamma_{o,t-i} * \Delta o_{t-i} + \gamma_{s,t-i} * \Delta s_{t-i} + \gamma_{e,t-i} * \Delta e_{t-i}\right) + \sum_{i=1}^{p} \gamma_{m,t-i} * \Delta m_{t-i} + \varepsilon_t^m$$

where
$\Delta o_t = o_t - o_{t-1}$, $\Delta s_t = s_t - s_{t-1}$, $\Delta e_t = e_t - e_{t-1}$, $\Delta m_t = m_t - m_{t-1}$,
ε_t^j = a structure impulse for a particular variable,
$j \in \{o, s, e, m\}$,
p = lag length.

Since crude oil is a tradable commodity and there are many significant oil producers in the world, Canada does not have much power to manipulate the market price of oil. So, the domestic capacity output, money stock and exchange rate from a single country cannot be considered as determinant factors for the evolution of oil prices in the real world, which is indicated in function (1) that the determination process of oil prices only depends on oil

prices in previous periods but not on the other three variables. Based on the theoretical framework discussed in Section 3.1, real supply, money stock and the real exchange rate will be treated as endogenous variables and are mutually dependent. Rewriting the above functions as follows:

$$B_0 X_t = \Gamma_0 + \sum_{i=1}^{p} \Gamma_i X_{t-i} + \varepsilon_t \tag{9}$$

where B_0 and Γ_i are coefficient matrices,

$$\varepsilon_t = [\phi_o \quad \phi_s \quad \phi_e \quad \phi_m]',$$
$$X_t = [\Delta o_t \quad \Delta s_t \quad \Delta e_t \quad \Delta m_t]',$$
$$\Gamma_0 = [\varepsilon_t^o \quad \varepsilon_t^s \quad \varepsilon_t^e \quad \varepsilon_t^m]'.$$

Multiplying both sides by the inverse of B0 to obtain the following formula:

$$X_t = A_0 + \sum_{i=1}^{p} A_i X_{t-i} + \mu_t \tag{10}$$

where

$$A_i = B_0^{-1}\Gamma_i = \begin{bmatrix} a_{o,i} & 0 & 0 & 0 \\ b_{o,i} & b_{s,i} & b_{e,i} & b_{m,i} \\ c_{o,i} & c_{s,i} & c_{e,i} & c_{m,i} \\ d_{o,i} & d_{s,i} & d_{e,i} & d_{m,i} \end{bmatrix},$$

$$A_0 = B_0^{-1}\Gamma_0 \ , \ \mu_t = B_0^{-1}\varepsilon_t = [\mu_t^o \ \mu_t^s \ \mu_t^e \ \mu_t^m]'.$$

In equation (6), the composition of structural impulse μ_t represents the linear combination of four structural impulses, ε_t's. In other words, shocks on any particular variable will have an impact on real exchange rates, which allows an exploration of dependencies between real exchange rates and other variables.

In addition to the assumption that real oil price is exogenous, there are other assumptions imposed on this model. According to the theory of neutrality of money (Patinkin 1987), money supply stocks only affect nominal variables in the short run, but it has no effect on real exchange rates in the long run, which is a strong but necessary assumption in this study. So the long-term restriction is:

$$\sum_{i=0}^{\infty} c_{m,i} = 0 \tag{11}$$

Based on the Cobb-Douglas production function, the domestic output level is determined, in the long run, only by supply side factors including the level of physical inputs and capital, productivity, among others (Blanchard 1989). Given that, in this model, real supply will only be affected by real supply itself and real oil prices. Thus, two long-term restrictions would be imposed:

$$\sum_{i=0}^{\infty} b_{e,i} = \sum_{i=0}^{\infty} b_{m,i} = 0 \tag{12}$$

Therefore, the system in equation (6) can be rewritten in matrix form as follows:

$$\begin{bmatrix} A_{11}(L) & 0 & 0 & 0 \\ A_{21}(L) & A_{22}(L) & 0 & 0 \\ A_{31}(L) & A_{32}(L) & A_{33}(L) & 0 \\ A_{41}(L) & A_{42}(L) & A_{43}(L) & A_{44}(L) \end{bmatrix} \begin{bmatrix} \Delta o_t \\ \Delta s_t \\ \Delta e_t \\ \Delta m_t \end{bmatrix} = \begin{bmatrix} A_{01} \\ A_{02} \\ A_{03} \\ A_{04} \end{bmatrix} + \begin{bmatrix} \mu_t^o \\ \mu_t^s \\ \mu_t^e \\ \mu_t^m \end{bmatrix} \tag{13}$$

where $L(\bullet)$ is an operator that represents the relation of states between two periods (i.e. $L^i(X_t) = X_{t-i}$, where $i \geq 1$). Also, equation (13) is equivalent to

$$A(L)X_t = A_0 + \mu_t \leftrightarrow X_t = A(L)^{-1}A_0 + A(L)^{-1}\mu_t \tag{14}$$

To avoid the problem of having too many parameters in the process of estimating VAR systems, this study estimates the reduced-form structure VAR model (equation (9)) rather than directly estimating equation (6). Moreover, $A(L)$ is a lower triangle matrix, which indicates it can be just identified as a structural matrix. Therefore, structure decomposition can be applied to the reduced-form mixture of structural impulses.

IV. DATA AND PRELIMINARY ANALYSIS

The data used in this study consists of monthly observations of the nominal exchange rate (CAD/USD) from the Federal Reserve Bank of Saint Louis, spot oil prices from the Energy

Information Administration (EIA), Canada's money stock, industrial production and the consumer price index (CPI) in the U.S. and Canada from the Organization for Economic Co-operation and Development (OECD). In particular, narrow money (M1) will represent money stock as M1 represents the most liquid share of total money supply, which could more accurately reflect the money stock for exchange purposes. Since GDP can only be calculated annually, monthly industrial production represents domestic supply. The time span of all data sets used in this study is from January 1995 to August 2015.

Since all variables in the structure VAR model proposed in Section 3.2 represent real terms, the raw data needs to be deflated in terms of corresponding CPI (Lizardo and Mollick 2010; Reboredo 2012). In particular, since crude oil is a tradable commodity and commonly denominated in U.S dollars, oil prices are deflated by the U.S. CPI. Furthermore, real exchange rates are obtained by deflating the nominal exchange rates according to relative CPI.

Prior to estimating the structure VAR model, this paper examines if all variables are integrated of the same order. Otherwise, non-stationary time-series data could cause deceptive empirical results. The Dicky-Fuller test (1979) is employed for that end. The test results in Table 1. indicate that the null hypothesis, H0: variable has a unit root, is accepted for all variables without taking differences and is rejected for all variables after taking the first difference at 1% significance level. Hence, the test results verify the assumption mentioned in Section 3.1 that real exchange rates are integrated of one. Thus, after taking first differences, all data series become stationary.

TABLE I
DICKEY-FULLER UNIT ROOT TEST

H_0: the variable has a unit root; H_1: not H_0.

LEVELS	OIL PRICES	INDUSTRIAL SUPPLY	MONEY STOCK	EXCHANGE RATES
With trend	−2.793529	−1.379001	−0.119029	−1.297796
Without trend	−1.536165	−0.463204	3.841722	−1.188618

FIRST DIFFERENCES	OIL PRICES	INDUSTRIAL SUPPLY	MONEY STOCK	EXCHANGE RATES
With trend	−10.51351*	−5.859282*	−12.72425*	−11.33457*
Without trend	−10.58409*	−5.339912*	−11.73030*	−10.21852*

*Note: * denotes the rejection of the null hypothesis at the 1% significance level.*

Finally, it is necessary to examine if the VAR system is dynamically stable for the optimal lag length. The VAR model is a stable system if the effect of new shocks on each variable diminishes with time. The lag length indicates that the number of previous periods considered in each autoregressive process. The larger lag length can reflect more features of the variable, but will also result in smaller degrees of freedom for the model. Here, the optimal lag length in the original VAR system is determined by employing the Likelihood Ratio test. We start from setting the maximum lag length as 8, then the null hypothesis, Ho: every element in the coefficient matrix A_p is equal to zero when the lag length is p, is rejected at 5% significance level when lag length is 6, see Table 2. In other words, the coefficient matrix A_6 has at least one element that is significantly different from zero, and the null hypothesis is accepted for all A_p when p ≥ 7. For the chosen lag length, the modulus of all roots calculated from the reverse characteristic function are strictly less than 1 as seen in Table 3, which indicates the original VAR system satisfies the stability condition.

TABLE II
LIKELIHOOD RATIO (LR) TEST

H_0: every element in the coefficient matrix A_p is equal to zero when the lag length is p; H_1: not H_0.

LAG	1	2	3	4	5	6	7	8
LR statistic	51.8355	31.6514	39.4936	18.6516	15.2710	27.2349*	17.4730	15.3695

*Note: * indicates lag order that rejects the null hypothesis at 5% significance level.*

TABLE III

Roots of Characteristic Polynomial
Endogenous variables: Oil Prices, Industrial Supply, Money Stock, Exchange Rates
Exogenous variables: C (constant)
Lag specification: 1 6
Date: 11/21/15 Time: 21:16

ROOT	MODULUS
0.705422 − 0.434049i	0.828262
0.705422 + 0.434049i	0.828262
0.781148 − 0.209883i	0.808853
0.781148 + 0.209883i	0.808853
−0.429171 + 0.679808i	0.803944
−0.429171 − 0.679808i	0.803944
0.122764 − 0.788636i	0.798134
0.122764 + 0.788636i	0.798134
−0.581863 + 0.456570i	0.739608
−0.581863 − 0.456570i	0.739608
−0.027569 − 0.725835i	0.726358
−0.027569 + 0.725835i	0.726358
−0.655955 + 0.251461i	0.702502
−0.655955 − 0.251461i	0.702502
−0.673253 − 0.080235i	0.678018
−0.673253 + 0.080235i	0.678018
−0.246747 − 0.628374i	0.675084
−0.246747 + 0.628374i	0.675084
0.654558	0.654558
0.326493 + 0.527984i	0.620778
0.326493 − 0.527984i	0.620778
0.403114 + 0.340954i	0.527969
0.403114 − 0.340954i	0.527969
0.314501	0.314501

No root lies outside the unit circle.
VAR satisfies the stability condition.

V. EMPIRICAL RESULTS AND LIMITATIONS

From this point on, the paper proceeds to estimate the constructed structural shocks and how the Canadian real exchange rate responds to them under the structure VAR model. Since the stability condition holds for the constructed VAR system, the impulse-response function (Enders 2014) can be employed to analyze how real exchange rates respond to the impulse imposed on each variable in each future period. Additionally, the variance decomposition method (Enders 2014) is applied to specify how each structural shock contributes to real exchange rates' response to composited structural shocks.

5.1 ANALYSIS OF IMPULSE RESPONSES

The impulse-response functions demonstrate the role each factor plays in the determination mechanism of the Canadian real exchange rate. The impact of a one standard deviation of every structural impulse on Canada's real exchange rates over a 16-month time span is displayed in Figures 2-4.

In Figure 2(a), a positive shock on real oil prices immediately causes an appreciation of approximately 1.12% in Canada's real exchange rates. Since Canada is an important oil-exporter in the world and assuming that Canadian exporters charge in CAD, foreign oil importers have to purchase more Canadian currency in the international financial market to keep the import level unchanged. The greater demand for Canadian dollar drives up its real value in the short run. This result is consistent with the hypothesis—that real oil prices are negatively related with the real value of U.S. dollars against oil-exporting countries' currency. Six months after the positive shock, the value of Canadian currency starts depreciating and such a depreciation effect lasts for about six months. For production purpose, an increase in oil prices causes higher production costs and a lower industrial demand for crude oil. Since, in the medium term, industries in oil-importing countries can adjust their production levels and their demand for oil to the new oil price, the increased cost of importing oil negatively impacts foreign demand for Canada's crude oil. As a result,

the declining demand for Canadian dollars adjusts real exchange rates to its long-run equilibrium. Since the accumulated effect of depreciation is weaker than that of appreciation, a permanent appreciation of 1.2% in Canadian currency is achieved after 12 months, demonstrated in Figure 2(b). Moreover, due to its small open economy, Canada's trade structure is relatively simple and heavily dependent on energy exporting. The trade structure of the U.S., however, is much more complicated. An increase in oil prices will proportionally increase more in Canada's price level of tradeable goods than in the U.S.'s price level of tradeable goods. It can then be expected that there will be a real appreciation in Canadian currency against USD.

A temporary and insignificant appreciation, approximately 0.08% in real exchange rates is found in Figure 3(a) after imposing a positive real supply shock. The Canadian real exchange rate begins facing depreciation pressures after six months. Figure 3(b) illustrates that the value of Canadian currency depreciates to its new equilibrium level after one year. An increase in Canadian output, in the short run, leads to an increase in demand for money as there are more goods and services to be purchased. For a given money supply, higher money demand causes higher domestic interest rates in the short-run money market equilibrium. The expectation of exchange rates remains unchanged in the short term, and Canadian currency appreciates temporarily thanks to the increase in relative interest rates. The long-term depreciation impact is tiny but persistent as seen in Figure 3(b). Theoretically, an increase in the relative supply of non-tradable goods drops the relative price level. According to the definition of real exchange rate:

$$q_{CAD/US} = \frac{E_{CAD/US} \times P_{US}}{P_{CAD}} \tag{15}$$

where $q_{CAD/US}$ = the real exchange rate. In this case, it is reasonable to have a depreciation in Canadian currency. Comparing shares of exported goods and services in total GDP between Canada and the U.S., Canada's export-GDP ratio is more than twice of U.S.'s from 2011 to 2013 in Table 4. As Canada

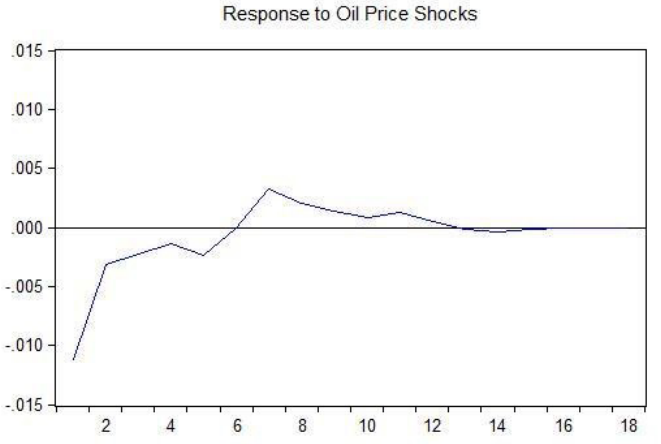


FIGURE 2(A)
Responses of real exchange rates to structural oil price shocks from period 1 to 18.

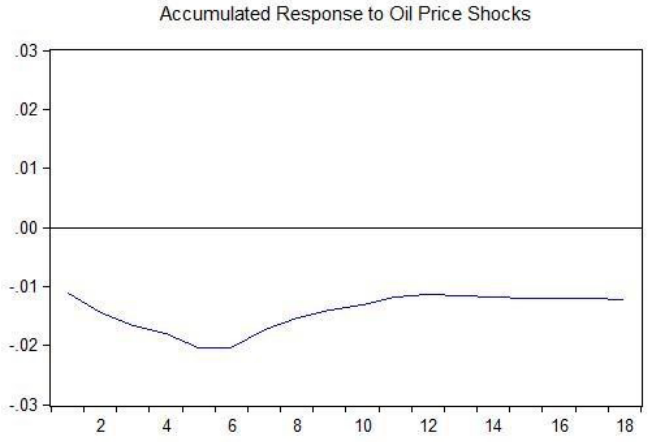


FIGURE 2(B)
Accumulated responses of real exchange rates to structural oil price shocks from period 1 to 18.

is a relatively smaller open economy and has a relatively larger export-GDP ratio, an increase in real supply only has a restricted impact on Canada's relative price level. Thus, using the results of this study, the influence of real industrial supply shocks on real exchange rates seems to be reasonably insignificant.

In Figure 4(a), a temporary depreciation of Canadian currency occurs in the first five months when a positive shock on real money supply is imposed. Later, the real exchange rate appreciates by a relatively smaller magnitude as seen in Figure 4(b). The real exchange rate stabilizes in the new long-run equilibrium level, indicating a permanent depreciation. This verifies the exchange rate overshooting hypothesis proposed by Dornbusch (1976). It is worth noting that money supply's effect on real exchange rates is also small. One possible explanation is that changes in money supply theoretically only has short-term impacts on nominal exchange rates and has no substantial effect on real exchange rates.

5.2 DECOMPOSITION OF REAL EXCHANGE RATE VARIATIONS

Analyzing the importance of each source of shocks to real exchange rates is helpful to understand how real exchange rates are determined in both the short and long term. For a one-standard-deviation structural shock, the endogenous variable, which has higher volatility, will lead to more dramatic fluctuations of real exchange rates. To reveal the relative importance of variables in this structure VAR model, this study employs the variance decomposition method to quantify each variable's degree of contribution to the variation of real exchange rates.

According to empirical results from Table 5, the real oil price shock has a dominant role in explaining fluctuations of real exchange rates. The proportion of fluctuations the shock contributes increases from 46.4% to 49.2% in the first 12 months. It then falls by a small portion to 48.9% in second year. It is noteworthy that the contribution of oil price shocks to real exchange rates is large and persistent throughout the estimation period.

TABLE IV
EXPORTS OF GOOD AND SERVICES (% OF GDP)

COUNTRY NAME	2011	2012	2013
Canada	30.6%	30.2%	30.2%
United States	13.6%	13.6%	13.5%

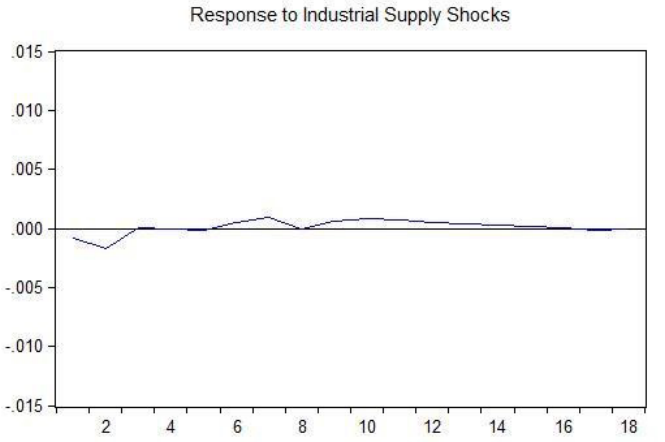


FIGURE 3(A)
Responses of real exchange rates to structural industrial supply shocks from period 1 to 18.

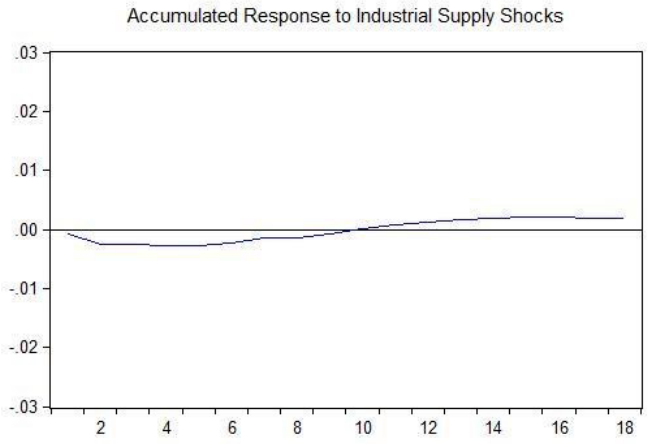


FIGURE 3(B)
Accumulated responses of real exchange rates to structural industrial supply shocks from period 1 to 18.

This impact can be partially explained by the special dependence structure of oil trade between Canada and the FU.S. According to data from EIA, the U.S. imported 39.2% of U.S. total imported quantity of oil from Canada in 2014. Thus, the U.S. is the most important oil importer for Canada, and Canada is the largest oil-importing source for the U.S., as well. Because of such a mutual dependence structure, shocks on oil prices can explain volatility of CAD-USD real exchange rates. Moreover, both Canada and the U.S. employ floating exchange rate regimes, which allow oil price shocks to impact the value of Canadian currency.

The influence of industrial supply increases from 0.2% to 2% throughout the estimation period implying that only limited variations of real exchange rates can be explained by real supply. Real supply shocks play a limited role in affecting domestic money demand in Canada, and hence can hardly cause outstanding exchange rate variations.

As monetary shocks only have nominal impacts (i.e. inflation effects) during the transition to the long-run equilibrium, in the short run, real exchange rates are almost independent of monetary factors. Although the money supply theoretically has no substantial effect on real exchange rates, under the floating exchange rate regime, investors' expectations can be efficiently reflected and may cause some overreactions (e.g., overshooting) when the real exchange rate returns to its long-run equilibrium value. Thus, approximate 1.5% long-run contribution from monetary supply is estimated in this study.

As a result, the variance decomposition analysis demonstrates that real oil price shocks are the primary sources to explain the volatility of real exchange rates.

5.3 LIMITATIONS

Due to the lack of monthly demand data, demand-side factors are not taken into account. The real demand, however, is seen as another factor to explain real exchange rate movement in many countries with either pegged or floating exchange rate regimes. Bjornland (2004) studied Norway and demonstrated that the shock of demand plays an important role in explaining

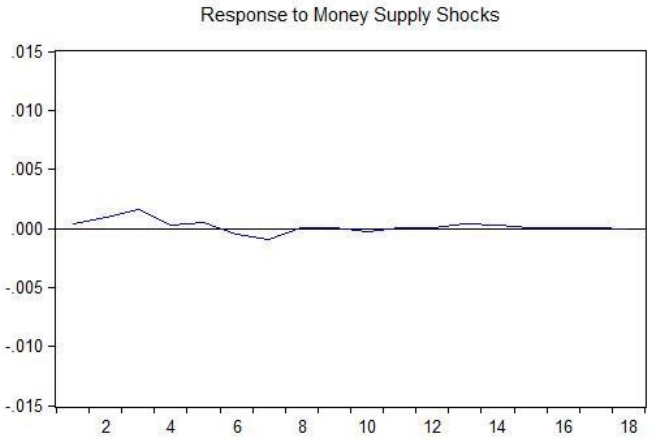


FIGURE 4(A)
Responses of real exchange rates to structural money stock shocks from period 1 to 18.

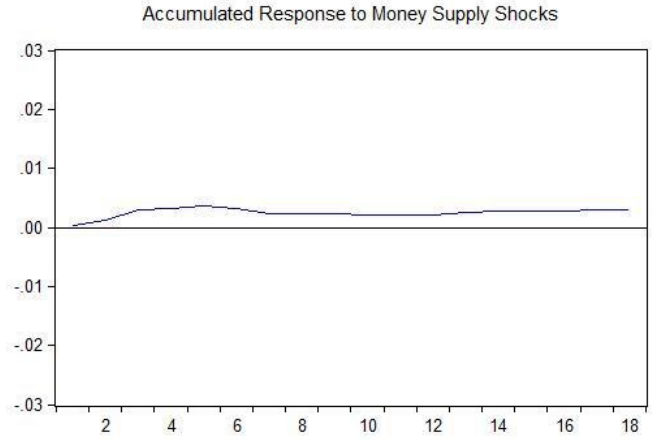


FIGURE 4(B)
Accumulated responses of real exchange rates to structural money stock shocks from period 1 to 18.

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the exchange rate movements. Huang and Guo (2007) estimate similar results for pegged exchange rates. Based on previous studies, if possible, real demand should be taken into account when analyzing the determination mechanism of real exchange rates.

Another limitation is that all data series were taken from the first difference, which may rule out some features and information regarding the data series. Without taking the first difference, an alternative treatment for non-stationary data is employing co-integration test to examine whether all four data series are co-integrated. This is employed in relevant studies (Huang and Guo 2007; Lizardo and Mollick 2010).

VI. CONCLUSION

Since oil prices in recent years have been unstable, investigating the connection between fluctuations in oil price and volatility of Canadian real exchange rates is informative for authorities to employ appropriate policies. The four-dimension structure VAR model consisting of oil prices, real supply, money stock and exchange rates, reveals how real exchange rates respond to fluctuations of the other three underlying factors in the short and long term, leading to several viewpoints.

Firstly, the empirical results indicate that a positive shock on oil prices will appreciate the Canadian currency in the long term. Relying on the special oil trade connection between Canada and the U.S., the oil price-exchange rate dependence structure found is consistent with findings in the literature, which is a negative relation between crude oil prices and the value of U.S. dollars against the oil-exporting countries' currency.

Secondly, by analyzing the impulse-response function, this paper reveals the extent that the real exchange rates respond to each particular structural shock: (a) real exchange rates immediately appreciate, then depreciate by a smaller magnitude, and finally reach an appreciated steady state with respect to a positive oil price shock; (b) fluctuations of real supply as well as monetary

TABLE V
VARIANCE DECOMPOSITION OF EXCHANGE RATES

PERIOD	S.E.	OIL PRICES	INDUSTRIAL SUPPLY	MONEY STOCK	EXCHANGE RATES
1	4.596740	46.41629	0.266829	0.053795	53.26309
2	4.827926	47.38217	1.293432	0.329882	50.99452
3	4.928831	47.71691	1.255278	1.228958	49.79886
4	4.942236	47.89184	1.244799	1.248813	49.61455
5	5.003474	48.28924	1.215975	1.276584	49.21820
6	5.006031	47.91783	1.274494	1.348758	49.45892
7	5.185558	48.65865	1.501369	1.520571	48.31941
8	5.242760	49.16124	1.480218	1.498858	47.85968
9	5.261750	49.24603	1.562830	1.485618	47.70553
10	5.270986	49.08160	1.766416	1.505020	47.64696
11	5.276551	49.22205	1.912718	1.495331	47.36990
12	5.278864	49.22415	1.983960	1.493722	47.29817
13	5.285335	49.08618	2.014199	1.538038	47.36159
14	5.289685	49.05127	2.034564	1.551280	47.36289
15	5.290804	49.02821	2.041665	1.551617	47.37851
16	5.291057	49.01262	2.041289	1.552178	47.39391
17	5.291308	48.99628	2.044595	1.554658	47.40446
18	5.291523	48.99166	2.046089	1.554513	47.40774
19	5.291659	48.98860	2.048067	1.557003	47.40633
20	5.291812	48.98691	2.050392	1.558228	47.40447
21	5.291832	48.98603	2.051844	1.558606	47.40352
22	5.291851	48.98586	2.052519	1.558659	47.40297
23	5.291922	48.98623	2.052722	1.558655	47.40240
24	5.291999	48.98662	2.052722	1.558669	47.40199

stock bring a persistent but insignificant depreciation pressure to the Canadian currency. Oil price shocks are found to be the primary contributor to the overall variation of real exchange rates.

Finally, some implications of monetary and fiscal policy in Canada are proposed, which help its central bank control recessionary or inflationary pressures, stimulate domestic investment and protect government expenditure from uncertain oil revenues.

Although there are some limitations on the constructed structural VAR model, this paper provides results that can partially illuminate the determination mechanism of Canada's real exchange rates during oil price shocks.

II

RESEARCH FEATURES

No Two Experiments are Identical

Jeffrey Pai

I. INTRODUCTION

When information is limited, individuals often find it difficult to make decisions. Sometimes they have some information available to assist them in their decision-making process. Other times, the individual may have no information at all. However, confidence in decision-making can be lacking in both scenarios. This lack of confidence is identified in Ellsberg's experiment, which tests for the relationship between risk aversion, the dislike towards risk, and ambiguity aversion, the dislike towards ambiguity (Ellsberg, 1961).

In Ellsberg's experiment, individuals were presented with two urnsceach containing 100 balls, either red or blue. Individuals were told that the first urn contained 50 red balls, and 50 blue balls. However, individuals were not given any information regarding the composition of the second urn, except that it contained 100 balls, either red or blue. In Ellsberg's experiment, individuals make a choice of either betting on the colour of a ball drawn from the first urn (risky urn), or betting on the colour of a ball drawn from the second urn (ambiguous urn). His research identifies and confirms that individuals are more likely to bet under situations where they are able to determine a probability of winning and thereby, betting on the risky urn rather than the

ambiguous urn. Thus, Ellsberg's experiment identified behaviours which reveal Knightian ambiguity aversion – the aversion to the ambiguity of a single urn's composition.

In this study, along with a variation of the Ellsberg experiment, individuals were presented with a slightly different experimental set-up. Two jars were presented to the participants—each containing 2 marbles which could be either green or blue. Additionally, individuals were not given any information regarding the jars' respective compositions, nor were they given any reason to believe that the composition of one jar had any relation to the composition of the other jar. Two marbles—one from each jar—were drawn after individuals made their bets. Individuals were instructed to make bets, however, they had to make a series of decisions of either betting on a certain colour of a marble drawn from one jar—blue or green, or betting on the colours of the two marbles drawnsame or different. Therefore, the intent for this experimental set-up is to observe whether or not individuals exhibit an aversion towards the relationship concerning the ambiguous compositions of the two jars. Specifically, we are observing whether or not individuals reveal a preference towards betting on the colour of a single marble drawn from one jar (uncertain bias), rather than the relationship of the marbles drawn from the two jars (uncertain relation between biases). We denote this type of behaviour as a preference for One over Two. Similarly, we denote the behaviour of a preference towards betting on the relationship of the marbles drawn from the two jars over betting on the colour of a single marble drawn from one jar as a preference for Two over One.

This study builds on the 2014 work of Yoram Halevy titled, "No Two Experiments Are Identical." Although the basic theory of studying the three-fold distinction between risk, uncertain bias (or composition), and the uncertain relation between biases remains unchanged, adjustments were made to the instructional framework in order to improve the robustness of the experiment's findings (Halevy & Epstein, 2014).

The motivation behind this study models the bets on the draws from several urns as situations where payoffs of a decision

depend on the realization of multiple random events (Halevy & Epstein, 2014). Consider the following example of optimal portfolio selection[1]. Suppose an investor is uncertain about the factors that may affect his/her rate of return on a security. Additionally, suppose that the investor believes in, and is averse to the ambiguity concerning the possible correlation between returns. If this is true, then the investor may not be confident with diversification and thus, limit his/her degree of stock market participation. The findings from our study supports the ideology behind this scenario, such that our data suggests that individuals undeniably exhibit a stronger aversion towards the ambiguity concerning the possible correlation between returns (uncertain relation between biases), over the ambiguity concerning the factors that affect the return rate on one investment (uncertain bias). Specifically, this study finds a lack of independence between uncertain bias and the uncertain relation between biases.

II. THEORY, METHODOLOGY, AND MOTIVATION

In probability theory, probabilistic sophistication is the assumption that one can assign measurable probabilities to justify their decisions, with the joint probability equal to 100% (Machina & Schmeidler, 1992). Using Ellsberg's experiment as an example, an individual would demonstrate probabilistic sophistication if he/she believes that the probability[2] of drawing either a red or blue ball from the first urn is exactly 50%. On the other hand, a violation of probabilistic sophistication would arise if the individual had the subjective belief that the joint probability did not sum to 100%. This concept is applied to the methodology of this study in the following manner.

In our experiment, one marble is drawn from each jar. Given that each jar contains two marbles—blue or green, there are four

1 Statistical explanation is referenced through an excerpt found in the full online version of the paper

2 In this paper, probabilities are denoted as P, with $0 \leq P \leq 1$ and $\Sigma P = 1$

possible pairs of marbles that can be drawn: green from the first jar and green from the second jar, denoted G_1G_2, green from the first jar and blue from the second jar, denoted G_1B_2, blue from the first jar and green form the second jar, denoted B_1G_2, and blue from the first jar and blue from the second jar, denoted B_1B_2. Therefore, the joint probability of drawing either a green or blue marble from the first jar can be denoted as,

$$P(G_1) = \{G_1B_1, G_1G_2\}$$

and,

$$P(B_1) = \{B_1G_2, B_1B_2\}$$

Likewise, the probability of the two marbles being identical or different can be denoted as,

$$P(Same) = \{G_1G_2, B_1B_2\}$$

and,

$$P(Diff) = \{G_1B_2, B_1G_2\}$$

Assuming that colours can be treated symmetrically, such that drawing either colour from the first jar is indifferent to the individual, it can be assumed that

$$G_1 \sim B_1, \text{and } P(G_1) = P(B_1)$$

If an individual bets exclusively on the colour of a marble drawn from one jar over the relationship of the two marbles drawn, the individual displays a preference for *One over Two*. This is a violation of probabilistic sophistication, as this behaviour implies that

$$P[(G_1) + (B_1)] > P[(Same) + (Diff)] = 1$$

Similarly, a preference for *Two over One* also violates probabilistic sophistication, as this implies that

$$P[(Same) + (Diff)] > P[(G_1) + (B_1)] = 1$$

With this intuition, a preference for *One over Two* indicates that the ambiguity regarding the relationship concerning the compositions of the two jars is more significant than the ambiguity of a single jar's composition.

In our variation of the Ellsberg experiment, participants were presented with two jars—each containing two marbles which could be either green or blue. The composition of one jar is unknown to the participants, therefore, it could contain either two green marbles, two blue marbles, or one green and one blue marble. However, the participants are informed of the composition of the other jar—referred to as the Ellsberg jar, which contains one green and one blue marble. Two marbles are drawn—one marble from each jar—after individuals are presented with options to bet on either a green (blue) marble being drawn from the jar of unknown composition (the ambiguous jar), or a green (blue) marble being drawn from the Ellsberg jar (the risky jar).

Given that the risky jar has a known composition of one green and one blue marble, when drawing one marble from each jar, the probability of drawing either a green or blue marble is exactly 50%, denoted as

$$P(G_3) = ½ \text{ and } P(B_3) = ½$$

where,

$$P(G_3) + P(B_3) = 1$$

Given the possible compositions of the ambiguous jar, $\{G_1G_1, G_1B_1, B_1G_1, B_1B_1\}$, when drawing one marble from each jar, the probability of drawing either a green or blue marble from the ambiguous jar can be denoted as

$$P(G_1) = \{G_1G_3, G_1B_3\}$$

and,

$$P(B_1) = \{B_1G_3, B_1B_3\}$$

The same concept to test for probabilistic sophistication is applied to our variation of the Ellsberg experiment to classify subjects as ambiguity averse, ambiguity seeking, indifferent to ambiguity, or neither indifferent nor averse to ambiguity.

III. EXPERIMENTAL DESIGNS

A total of 230 subjects were recruited from UBC's Vancouver School of Economics subject pool using ORSEE (Greiner, 2004) to participate in an experiment in decision making. Two experimental designs were employed to test for the hypothesized behaviour of *One over Two*: 1) Pairwise (153 participants) and 2) Choice List (77 participants). Participants of the Pairwise Experiment were given the following six choice problems to answer, each organized into three pairs of bets to establish upper and lower bounds through classifying strict and weak preferences.

Consider Figure 2. In Choice 1', the participant is free to choose whichever bet he/she wants. When analyzing the choice problems, we do not infer a strict preference nor a weak preference if an individual chooses to bet on the marble being drawn from the fixed jar being green (blue). Likewise, the same inference is not applied if the individual chose to bet on the two marbles drawn to be of different (or same) colours. However, through comparing the participants' bets in Choice 1 and Choice 1'' with the bet in Choice 1', strict or weak preferences can be assigned. For example, circling (a, c, e) implies a strict preference for betting on *Green* over *Diff*, *(Green > Diff)*, and circling (b, d, f) implies a strict preference for betting on *Diff* over *Green*, *(Diff > Green)*. Weak preferences are identified when participants exhibit monotonic and transitive choices across the bets, but switch from betting on

1. *Green vs Diff*
   Bets between drawing a green marble from the fixed jar, or the marbles drawn from the two jars are of different colours

2. *Blue vs Diff*
   Bets between drawing a blue marble from the fixed jar, or the marbles drawn from the two jars are of different colours

3. *Blue vs Same*
   Bets between drawing a blue marble from the fixed jar, or the marbles drawn from the two jars are of same colours

4. *Green vs Same*
   Bets between drawing a green marble from the fixed jar, or the marbles drawn from the two jars are of same colours

5. *Ellsberg: Ambiguous Green vs Risky Green*
   Bets between drawing a green marble from the fixed jar, or drawing a green marble from the Ellsberg (risky) jar, which has exactly one green and one blue marble

6. *Ellsberg: Ambiguous Blue vs Risky Blue*
   Bets between drawing a blue marble from the fixed jar, or drawing a blue marble from the Ellsberg (risky) jar, which has exactly one green and one blue marble

Figure 1: Choice Problems 1-6 of the Pairwise Experiment

Choice 1 (circle a or b)	Choice 1' (circle c or d)	Choice 1'' (circle e or f)
A $25 if the marble drawn from the fixed jar is green (green from both jars, or green from the fixed jar and blue from the other jar).	**C** $25 if the marble drawn from the fixed jar is green (green from both jars, or green from the fixed jar and blue from the other jar).	**E** $26 if the marble drawn from the fixed jar is green (green from both jars, or green from the fixed jar and blue from the other jar).
B $26 if the two marbles drawn are of different colours (green from Jar #1 and blue from Jar #2, or blue from Jar #1 and green from Jar #2)	**D** $25 if the two marbles drawn are of different colours (green from Jar #1 and blue from Jar #2, or blue from Jar #1 and green from Jar #2)	**F** $25 if the two marbles drawn are of different colours (green from Jar #1 and blue from Jar #2, or blue from Jar #1 and green from Jar #2)

Figure 2: Choice Problem 1

Green to betting on *Diff*, or vice versa when offered a premium. For example, circling (b, c, e) implies a weak preference for *Green* over *Diff*, *(Green ≥ Diff)*. The same concept is applied to the analysis of the rest of the choice problems for strict and weak preferences.

Behaviours and preferences were identified through observing subjects' responses to the choice problems and comparing them from one choice problem to another. A similar analysis was undertaken on subjects' responses in the Choice List Experiment—where subjects made a sequence of choices between bets and sure amounts for six choice lists—for the same purpose.

IV. EXPERIMENT RESULTS

24 subjects from the Pairwise Experiment and 7 subjects from the Choice List experiment were removed from the analysis due to either violating monotonicity or transitivity, or not understanding the instructions. The following tables summarize our findings[3].

3 AA: Ambiguity Averse, WAA: Weakly Ambiguity Averse, AS: Ambiguity Seeking, WAS: Weakly Ambiguity Seeking, IND: Indifferent, NINA: Neither Indifferent Nor Averse, 1>2: *One over Two*, 2>1: *Two over One*. A full explanation of the classifications can be found in the full online version of the paper.

TABLE I

ONE VS TWO
129 Subjects
Transitive Within Choice Problems
Transitive Across Choice Problems

	AA 1 > 2	AA 2 > 1	AS 1 > 2	AS 2 > 1	IND 1 > 2	IND 2 > 1
Total Observations	40	24	10	4	7	1
Upper Bound (Strict)	10	6	-	-	4	-
Lower Bound (Weak)	31	18	10	4	3	1

Table 1: Ambiguity and One vs Two for the Pairwise Experiment

TABLE II

ONE VS TWO
STRICT PREFERENCES ONLY
129 Subjects
Transitive Within Choice Problems
Transitive Across Choice Problems

	AA 1 > 2	AA 2 > 1	AS 1 > 2	AS 2 > 1	IND 1 > 2	IND 2 > 1
Strict Preferences to Ambiguity	10	6	-	-	4	-
	WAA 1 > 2	WAA 2 > 1	WAS 1 > 2	WAS 2 > 1		
Weak Preferences to Ambituity	8	4	2	-	-	-

Table 2: Ambiguity and Strict Preferences for One vs Two for the Pairwise Experiment

TABLE III

ONE VS TWO
70 Subjects
Colour Symmetric Beliefs
Transitive Across Choice Lists

	AA 1 > 2	AA 2 > 1	AS 1 > 2	AS 2 > 1	IND 1 > 2	IND 2 > 1	NINA 1 > 2	NINA 2 > 1
Total Observations	11	14	7	1	7	1	4	2
Upper Bound (Strict)	7	13	4	1	6	1	3	2
Lower Bound (Weak)	4	1	3	-	1	-	1	-

Table 3: Strict and Weak preferences for One vs Two in the Choice List Experiment

4.1 KNIGHTIAN AMBIGUITY AND ONE VERSUS TWO

Aggregating the data from the Pairwise Experiment and the Choice List Experiment, out of 199 subjects (129 from the Pairwise Experiment, 70 from the Choice List Experiment), approximately 65% of the subjects exhibited ambiguity aversion, 21% responded to the experiments in a way that either revealed indifference, or, neither indifference nor aversion to the ambiguity of the jar with unknown composition, and 15% were ambiguity seeking.

Approximately 43%[4] of subjects demonstrated a preference for One over Two, while approximately 24% revealed a preference for Two over One. These findings justify the ideology that individuals exhibit a stronger aversion towards the relationship concerning the ambiguous compositions of two jars, over the ambiguous composition of one.

ONE OVER TWO & AMBIGUITY AVERSION

Ambiguity Averse	One over Two 0	1	Total
0	36	34	70
1	78	51	129
Total	114	85	199

Pearson chi2(1) =	1.5143	Pr = 0.218
likelihood-ratio chi2(1) =	1.5091	Pr = 0.219
Fisher's exact =		0.233
1-sided Fisher's exact =		0.140

Based on our data in Figure 2, we find significant evidence suggesting that an individuals' aversion to the ambiguity of a single jar's composition is strongly associated to their aversion towards the relationship concerning the two jars' respective compositions.

4 Includes subjects that exhibited either strict or weak preferences. The rationale for including weak preferences in the data analysis can be found in the full online version of the paper.

4.2 UPPER & LOWER BOUND RATIONALE

In our experiment, the differing payments between the choices of bets within each choice problem is denoted as \$25 + £, where £ represents the \$1 premium paid (4% of the initial \$25). It is important to understand that the subjects may behave differently when the premium offered is decreased, such that a 0.4% premium (£ = \$0.10) may encourage strict preferences when making decisions in the choice problems. For example, offering \$25.10 rather than \$26 as the premium in Choice Problem 5[5] would not provide a significant incentive for the individual to switch from betting (b, d, f) to (b, d, e). Therefore, a lower bound to classify Knightian Ambiguity Aversion is employed when identifying weak preferences for betting on the risky jar, such that the subject circles (b, d, e) for both Choice Problems 5 and 6. Similarly, a lower bound to classify *Weakly Ambiguity Seeking (WAS)* behaviour can be identified if subjects circled (b, c, e) for both the same choice problems. This new approach of setting upper and lower bounds to include strict and weak preferences improved the robustness of our findings for behaviours under uncertainty bias and the uncertain relation between biases through our experiment.

If our findings excluded the lower bound classification of ambiguity aversion, only 39% of subjects from the Pairwise experiment would be classified as averse to Knightian ambiguity. This would contradict Ellsberg's robust findings by suggesting that people are in fact, not ambiguity averse. Therefore, the inclusion of weak preferences when assessing the behaviour classifications of our subjects is justified.

The same intuition regarding the significance of the premium percentile offered across bet pairs can be utilized to understand the high ratio of strict to weak preferences identified in subjects' responses to choice problems 1 through 4 when classifying preferences for *One over Two* and *Two over One.* In Table 1, 40 subjects

5 Bets in Choice Problems 1 through 6 are presented in the same format as Figure 2 and only differ with regards to the comparisons displayed in Figure 1

were identified to be averse to Knightian Ambiguity while also exhibiting preferences for *One over Two,* however, only 10 of these are identified as strict preferences. By including weak preferences into our analysis, we are able to identify 31 additional preferences for *One over Two* to improve the robustness of the experiment findings. Although this three-fold increase may generate discussions that challenge the appropriateness of the decision to include the weak preferences, this paper argues and stresses the significance of the percentile of the premium's impact on the subjects' behaviours when making their decisions throughout the experiment to support our claims.

GDP Growth Engines for Least Developed Countries and Policy Recommendations

BIG DATA BIG IMPACT: ECONOMICS DATA SCIENCE COMPETITION
1ST PLACE UNDERGRADUATE TEAM
Benjamin Lim, Lilian Lau, Prapon Wonsangaroonsri, Taeyoon Lee

Executive Summary: *This paper identifies exports as a major growth engine for LDCs. Rather than access to market factors (i.e. trade openness), the limiting factors holding back LDCs' export growth are low levels of capital investment and poor labour force characteristics (i.e. health). This paper then puts forth policy recommendations for the Central African Republic, which suffers from both low real GDP and export growth. The policy recommendations mainly suggest improvement in the healthcare system and adoption of pro-investment policies, which will stimulate GDP growth via the export channel.*

I. INTRODUCTION, DATA AND METHODOLOGY

The United Nations (UN) currently designates 48 countries as Least Developed Countries (LDCs)[1], which are the subjects of the UN's 2030 Sustainable Development Goals (SDGs). This paper will use data from the World Bank[2] (WB), from 2005–2014, to identify key factors impeding GDP growth and provide recommendations for the Central African Republic (CAF) to increase

1 United Nations, "List of Least Developed Countries," 2016, www.un.org/en/development/desa/policy/cdp/ldc/ldc_list.pdf.

2 The World Bank, "World Development Indicators," 2016, http://data.worldbank.org/data-catalog/world-development-indicators.

GDP growth. To do this, this paper identifies correlations of GDP and a wide range of relevant variables, focuses on important groups of variables and constructs a regression model to further investigate this relationship.

II. FINDINGS

Firstly, Figures 1 and 2 visually identify correlations between the LDCs' GDP and a range of development variables to discover key relationships. The process started with 1300 variables and, then, systematically pruned based on the number of available observations. This analysis shows that export-related variables are positively correlated to GDP and GDP growth for most LDC countries. Furthermore, total population and health-related variables are positively correlated to GDP and GDP growth. Secondly, Table 1 describes key differences between high-growth and low-growth LDCs. An observation (a country in a particular year) is considered high growth if it exceeds 7% growth rate[3] in that particular year and low growth otherwise. There are a number of key differences between the two groups in export categories. Both export growth and the export value index is much higher in high-growth LDCs than low-growth LDCs. Figure 2 illustrates the relationship between GDP growth and exports in greater details, where a strong positive relationship between the two variables could be seen for the LDC countries. The GDP-export relationship is further strengthened by Figure 3, which shows a scatter plot of export growth and GDP growth across LDC countries (based on average rates across 2005-2014). This reveals a positive GDP-export relationship. With the CAF showing as a low growth, low export country, this paper will later focus on policy recommendations for this country.

Figure 1 further shows that labour force, total population and capital formation rates to be much higher in high-growth

3 United Nations, "Transforming our World: the 2030 Agenda for Sustainable Development", *Sustainable Development Knowledge Platform*, 2015, https://sustainabledevelopment.un.org/post2015/transformingourworld.

observations. However, export costs, trade policies index and tariff are not significantly different between the high and low growth. This suggests that the production side of exports rather than trade access is the limiting factor export growth. Hence, this paper recommends increasing the factor of production, particularly labour force and capital formation, to boost GDP growth.

To increase the robustness of the correlational findings on exports, Table 2 reports the results of a fixed effect regression model, employed for a regression analysis of components affecting GDP and GDP growth rate. To capture non-linearity of effect on growth, interactions between the variables and high-growth variable are added to the model. As shown in column [1], there exists a number of statistically significant positive variables affecting real GDP including consumption and government expenditure. However, in column [2], aside from export growth most of the variables are no longer statistically significant in the regression on GDP growth. The only exception is growth in consumption, which is statistically much weaker compared to the real GDP regression. Due to its highly statistically significant relationship with both real GDP and GDP growth, the regression analysis verifies exports as a main channel in driving growth in LDCs.

The relationship between capital formation and labour force with export is also verified through the regression on export variables. As seen from column [3], there exists statistically significant and positive relationship for both labour and capital, implying that both are important factors of production which is a necessary build-up for production of goods prior to export.

III. POLICY RECOMMENDATIONS

From earlier findings, exports have a strong positive relationship with GDP, and labour force and capital formation are key factors to increasing export growth. Thus, recommendations to improve the labour force and capital formation are expected to have the most impact on CAF due to its low growth and low export characteristics. Thus, this paper

focuses on the following policy recommendations for CAF: (1) improve the quality and accessibility to health care to increase labour force and (2) develop pro-investment policies such as tax rebates and subsidies to investments. Table 2 column [4] indicates statistically significant and positive relationship between labour participation rate and health indicators such as measles immunization and access of clean water and negative with percentage of malnourished population and tuberculosis incidents.

IV. CONCLUSION

This paper identifies a strong GDP-export relationship for LDCs over 2005–2014. Exports in the LDCs are influenced critically by their labour force characteristics and capital formation. With this, this paper presents policy recommendations for CAF, a low GDP growth and low export country. The key recommendations are twofold: to improve the quality of the labour force by improving health care and to stimulate capital formation by developing pro-investment policies.

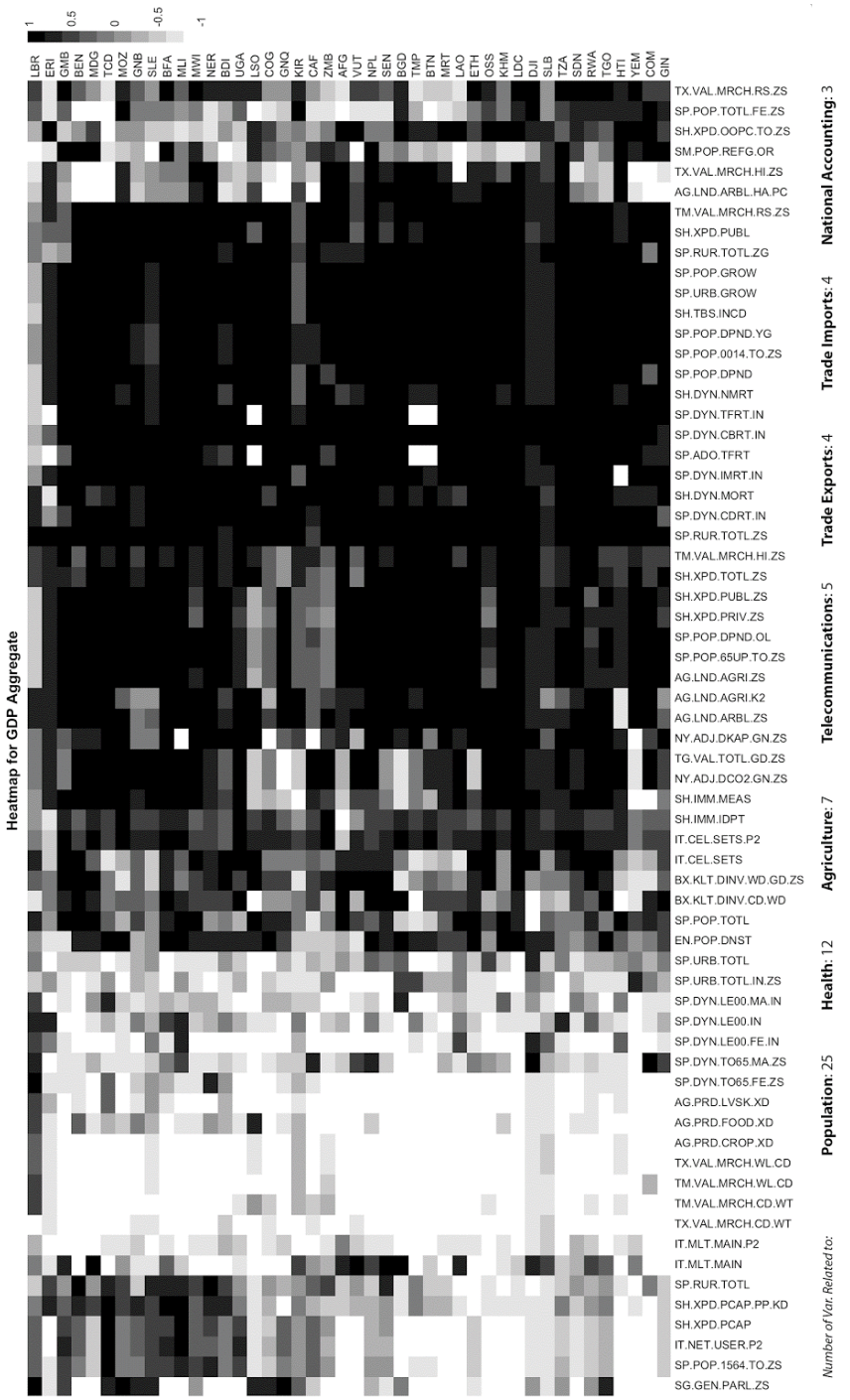

Figure 1. Heat Map for Aggregate GDP

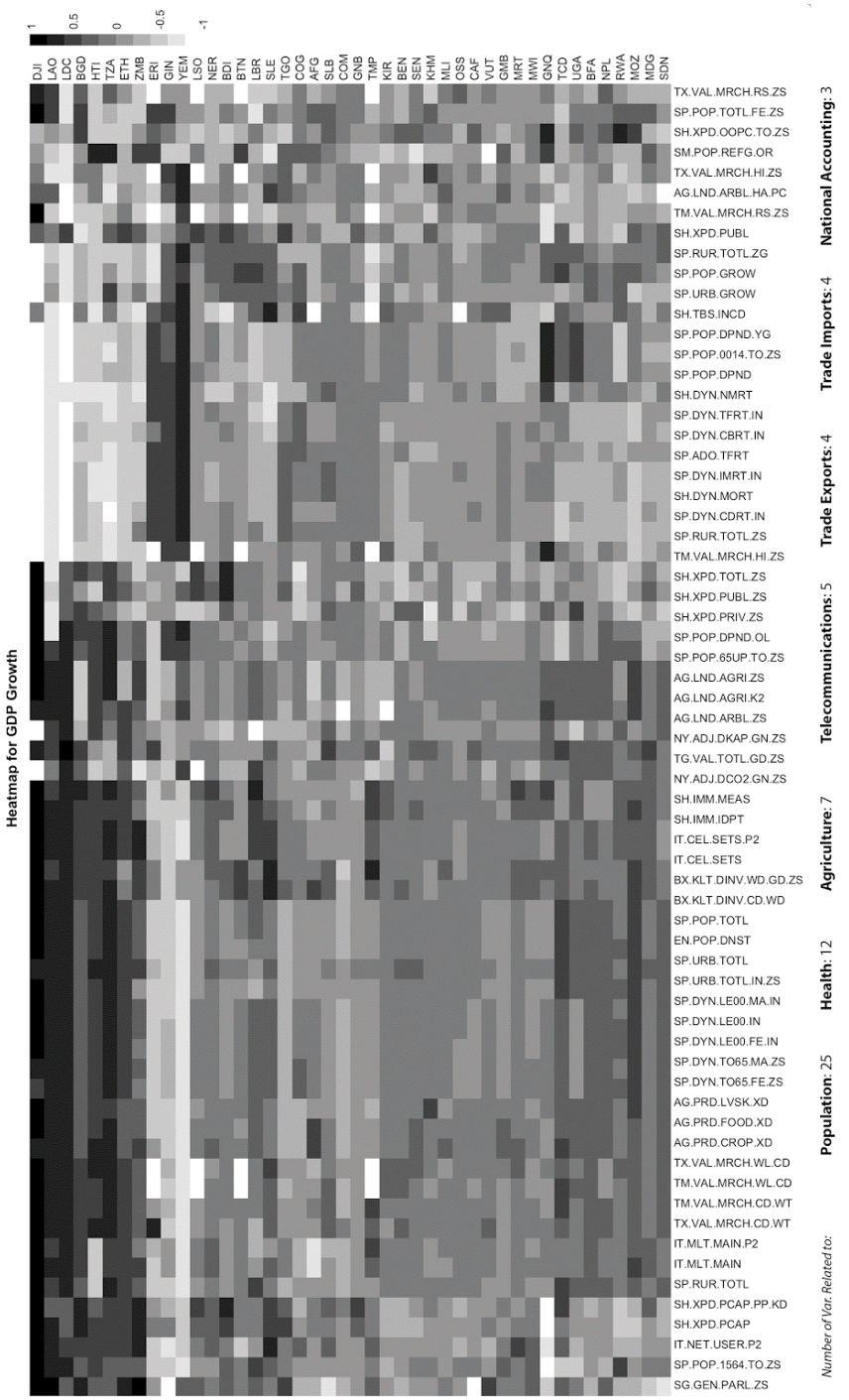

Figure 2. Heat Map for GDP Growth

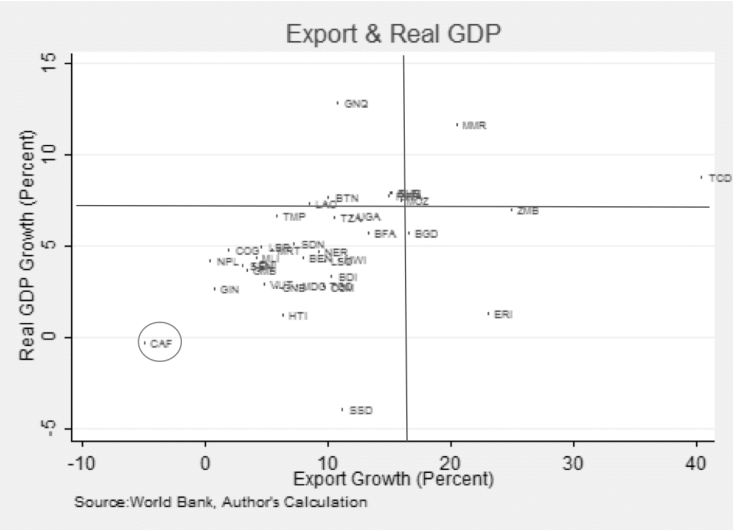

Figure 3. Scatter Plot of Export Growth and Real GDP Growth across LDC countries

	[1] High-Growth LDCs (Avg. 2010-14)			[2] Low-Growth LDCs (Avg. 2010-14)		
Panel A: GDP & GDP Component						
	Mean	Min	Max	Mean	Min	Max
GDP growth	9.28	7.00	20.91	3.01	-46.08	6.97
	(2.64)			(5.70)		
Aggregate GDP (hundred thousands)	8,940.00	585.00	30,600.00	9,670.00	111.00	119,000.00
	(8160.00)			(19000.00)		
Export growth	19.54	-10.36	233.07	5.93	-91.88	54.67
	(40.52)			(15.63)		
Export value index* (2000 = 100)	1264.08	111.55	16112.57	478.49	35.14	2679.41
	(2707.34)			(483.55)		
Panel B: Factors of Production						
Labour force (hundred thousands)	10.40	0.21	47.00	7.10	0.06	79.00
	(13.20)			(13.50)		
Labour participation rate	75.05	38.60	90.60	72.22	38.70	90.60
	(13.38)			(11.84)		
Gross capital reformation rate	30.08	0.00	67.65	26.32	6.60	67.91
	(14.67)			(11.74)		
Panel C: Trade Indicators						
Export cost	2175.60	410.00	6615.00	1935.53	410.00	6615.00
	(1480.77)			(1306.75)		
Trade policies index	3.63	1.50	4.50	3.68	1.50	4.50
	(0.66)			(0.55)		
Tariff	12.44	6.52	18.18	11.41	2.50	19.30
	(3.19)			(3.32)		

*The export value index uses export value in 2000 as the baseline.

Table 1. Summary Statistics between High-Growth and Low-Growth LDCs

Table 2: Fixed Effect Regression of GDP, Export, and Labour Components

	[1]		[2]		[3]		[4]
	Real GDP		*GDP Growth*		*Exports*		*Labour Force Particip*
Panel A: Real GDP		***Panel B: GDP Growth***		**Panel C: Export**		***Panel D: Labour Force***	
Exports (Dollars)	0.610***	Export Growth	0.0917***	Capital Formation (Dollars)	0.00537***	Tuberculosis (per 100,000 persons)	-0.00291**
	(0.0561)		(0.0177)		(0.0007)		(0.0009)
High Growth * Exports	0.134**	High Growth * Export Growth	1.13e-09***	High Growth * Capital Formation	-0.00290***	High Growth * Tuberculosis	0.0017
	(0.048)		(0.000)		(0.001)		(0.001)
Labour Force	0.00835***	Labour Growth	0.0162	Labour Force (Person)	175.6*	Measles Immunization (% Children)	0.0155*
	(0.001)		(0.026)		(71.6300)		(0.0068)
High Growth * Labour Force	-0.00172*	High Growth * Labour Growth	0.0017	High Growth * Labour Force	104.2***	High Growth * Measle Immunization	-0.0065
	(0.001)		(0.093)		(19.2300)		(0.0097)
Capital Formation (Dollars)	85.3100	Capital Formation Growth	0.0203			Population with HIV (%)	-0.0262
	(63.780)		(0.016)				(0.0560)
High Growth * Capital Formation	3.6210	High Growth * CapForm Growth	0.0004			High Growth * Population with HIV	0.0020
	(18.040)		(0.019)				(0.0433)
Consumption Expenditure (Dollars)	1.098***	Consumption Expenditure Growth	0.127*			Population Undernourished (%)	-0.0403***
	(0.046)		(0.052)				(0.0103)
High Growth * Consumption Expenditure	0.0259	High Growth * CE Growth	-0.0887			ligh Growth * Population Undernourishec	0.0182*
	(0.036)		(0.053)				(0.0087)
Government Expenditure (Dollars)	0.405***	Government Expenditure Growth	0.0349			Access to Clear Water (% Population)	0.0952***
	(0.109)		(0.118)				(0.0139)
High Growth * Government Expenditure	0.0881	High Growth * GE Growth	0.0565			High Growth * Water Access	-0.0203
	(0.106)		(0.196)				(0.0108)
Import (Dollars)	-0.561***	Import Growth	-0.0787				
	(0.048)		(0.101)				
High Growth * Import	-0.102*	High Growth * Import Growth	-0.0336				
	(0.045)		(0.170)				
Country Fixed Effect	Yes	Country Fixed Effect	Yes	Country Fixed Effect	Yes	Country Fixed Effect	Yes
Year Fixed Effect	Yes	Year Fixed Effect	Yes	Year Fixed Effect	Yes	Year Fixed Effect	Yes
N	429	N	258	N	474	N	776

*Standard error in parentheses.
* Dollars are in constant 2005 term
* p<0.05, ** p<0.01, ***p<0.001

Table 2. Fixed Effect Regression of GDP, Export, and Labour Components

III

HONOURS THESIS

Trade Liberalization, Child Labour, and Human Capital Investments in Brazil

Jamie Koerner

I. INTRODUCTION

Over the past few decades, tariff protection levels in developing countries have fallen to historically low levels. Following predictions of the classic Stolper–Samuelson theorem, proponents of trade liberalization have argued that international trade will ultimately eradicate poverty and inequality in developing countries through rising real wages for unskilled workers (see for example Bhagwati and Srinivasan 2002). While standard trade theory is clear on the gains from trade[1], many have emphasized the considerable adjustment costs borne by workers in formerly protected industries through falling wages and the loss of employment (see for example Topalova 2005 on India; Castilho, Menendez and Sztulman 2012 on Brazil). However, little is known on the impact trade policy might have on children.

A better understanding of the effects of trade reforms on children is essential for evaluating the long-run consequences of policy measures. For instance, trade policies that affect child labour and schooling can influence human capital investments and

1 Gains from trade are commonly expected to result from the specialization in production based on comparative advantage and from increasing consumption possibilities

ultimately long-run economic growth. However, theoretical work fails to offer clear predictions on the relationship between trade policy and the use of a child's time. The effects depend on the relative significance of the channels through which trade policy might work (such as relative prices, the real income distribution, wages, and net returns to education), the relative magnitude of resulting substitution and income effects and the importance of parental preferences. Consequently, how trade reforms affect the use of a child's time is ultimately an empirical question.

Nevertheless, while numerous studies have focused on the distributional effects of trade reforms in developing countries (see for instance, Suryahadi 2001 on Indonesia; Brandt and Benjamin 2004 on Vietnam; Goldberg and Pavcnik 2005 on Colombia; Topalova 2005 on India; Ferreira, Leite and Wai–Poi 2007, and Castilho et al. 2012 on Brazil), only few studies have focused on the impact on children. The contrasting effects of trade liberalization on child labour and schooling outcomes found in recent case studies (see Edmonds and Pavcnik 2005b on Vietnam; Edmonds, Pavcnik, and Topalova 2010 on India; Kis–Katos and Sparrow 2011 on Indonesia; Atkin 2012 on Mexico) indicate that the effects of trade reforms on children are most likely context-specific and more research is required to explore this issue in other developing countries.

This paper contributes to the micro-empirical literature by analyzing the subject in the context of Brazil, which embarked on an extensive trade liberalization program in the early 1990s. Using an employment-weighted tariff measure and detailed household-level micro data, this study examines whether changes in child labour and schooling varied across Brazilian states that differed in their exposure to trade. The tariff measure is constructed by combining pre-reform industrial composition of employment with temporal variation in tariff lines to measure the extent of trade exposure at state-level. My identification strategy follows conventions in the recent literature on trade liberalization (see for example, Topalova 2005; Edmonds et al. 2010; Kis–Katos and Sparrow 2011; Castilho et al. 2012).

Brazil is well suited for this type of analysis for at least two

reasons. First, prior to trade liberalization, Brazil was one of the most protected countries in the world (Gaddis and Pieters 2012). The primary goal of the large tariff reductions imposed on industries in the early 1990s, that were the result of internal events and international trade negotiations, was to decrease tariffs and to reduce variation in cross-industry nominal protection (Kovak 2013; Abreau 2004; Kume, Piani and Souza 2003). Moreover, due to its size and geographic location, Brazil exhibits significant spatial variation in the structure of production. The combination of large temporal variation in tariff lines across industries and geographic heterogeneity in the structure of production implies significant variation in the tariff measure across space and time. This offers a valuable basis for identifying the regional effects of trade liberalization. Second, this study benefits from a nationally representative household survey that provides detailed and consistent data covering a period starting well before trade liberalization. Unlike much of the existing literature, this dataset allows for the possibility to analyze changes in both child labour and schooling during the entire period of trade reforms. Furthermore, the survey provides extensive data on individual and household-level characteristics. This makes it possible to examine the differential effects of trade reforms across children from various socioeconomic backgrounds. Such rich data is rarely available in developing countries.

It is important to note several limitations of this analysis. First, since this study exploits regional variation in trade exposure to analyze the effects of tariff reductions on child labour/schooling, it cannot examine countrywide changes in the outcomes of interest as a result of trade liberalization. Second, the construction of the tariff measure implies that this paper focuses on the effects of trade liberalization through differences in the local structure of production. Similar to Edmonds et al. (2010) and Kis–Katos and Sparrow (2011), I therefore abstract from the effects of trade reforms on consumption patterns. Third, this study focuses on the short-to medium run effects of tariff reductions, since an important assumption underlying this type of analysis is that labour mobility is low across regions. In the long run, wages and,

consequently household incomes, are expected to converge to similar levels between regions through cross-regional migration. This should dampen the differential effects of trade reforms across Brazilian states (Castilho et al. 2012). Fourth, it should be noted that this paper offers only a reduced- form analysis, since it does not identify the transmission channels through which decreased tariff protection affected child labour/schooling outcomes in Brazilian states. While it is possible to conjecture about how the outcomes of interest were affected given the estimated results, this paper relies mostly on previous research to infer about potential transmission channels.

Finally, one important limitation arises from the use of the Brazilian National Household Survey (PNAD) because it only reports state-level geographic information. As a consequence, the state must be the appropriate labour market from the household's perspective in order for national tariff reductions to have differential impacts on state outcomes through employment composition (Edmonds et al. 2010). If, for instance, the state is too aggregated, there will be errors in the measurement of the trade exposure considered in this study (Edmonds et al. 2010). A second problem from utilizing state level data in Brazil is that it results in only a limited number of cross-sections.[2] To avoid this problem, other authors have considered an alternative approach. Gaddis and Pieters (2014) and Kovak (2011, 2013) use Brazilian census data to identify 494 micro-regions, which are "groupings of economically integrated contiguous municipalities with similar geographic and productive characteristics" as defined by IBGE (Kovak 2013).

Yet, while this approach allows for a more disaggregated analysis, one drawback is that it uses 1991 and 2000 census data to analyze the effects of trade liberalization between 1990 and 1995. This makes it difficult to isolate the effects of tariff reductions from certain macroeconomic policies enforced in 1996 to control the growing trade deficit and from the impact of the

2 Brazil consists of 27 federal states. The state Tocantins was created in 1988 from the northern part of the state of Goiás, but the distinction between the two states was not made in the Brazilian household survey until 1992

1997 Asian financial crisis. Furthermore, using 2000 census data to analyze the effects of trade reforms on child activities has its disadvantages. For example, one would have to control for certain policy interventions implemented in 1996 and in later years aimed at eradicating child labour if these policies were correlated with tariff reductions. The question of which approach is more appropriate in the case of Brazil derives its importance from the contrasting findings in Gaddis and Pieters (2012, 2014). These authors find different effects on female labour force participation in response to Brazilian trade reforms when using the two different approaches. Nevertheless, to be able to use the detailed data provided by the annually repeated household survey, the Brazilian state will be considered the unit of analysis in this study.

This paper shows that Brazilian states with greater exposure to trade have experienced smaller increases in schooling outcomes among 10 to 14 year olds relative to the national trend. The effects are strongest for girls in rural areas from high-skilled backgrounds. A decline in the standard of living in these households due to a trade liberalization induced fall in the economy-wide skill premium, found in previous research, is likely to be the underlying channel that is driving the effects. Children, in particular girls, were presumably taken out of school to save schooling costs. The observation of a stronger link between a fall in the standard of living and a decline in schooling in rural areas is likely due to significant differences in urban and rural school quality (and consequently in net returns to education). There is weak evidence for an increase in child labour as only one group seems to have increased their labour supply—boys in urban areas from low-skilled agricultural backgrounds. A trade induced poverty and inequality increase in urban areas, found in previous literature, may explain this result.

This paper proceeds as follows. Section II provides a review of the existing theoretical and empirical literature on trade liberalization, child labour and schooling. Section III introduces the data sources used for the analysis, presents a brief insight into the circumstances surrounding the Brazilian trade liberalization

program, and shows descriptive trends in tariffs and child labour/schooling outcomes. Section IV outlines the empirical strategy, while Section V presents and discusses the estimated results. Section VI concludes.

II. THEORY AND LITERATURE

Theoretical work has long been concerned with the determinants of child labour and the implications for optimal policy behaviour. Research has primarily focused on the harmful effects of child work on children's health outcomes and on long run economic growth through its impact on human capital investment and its theoretical link to poverty traps (see for instance, Barham, Boadway, Marchand and Pestieau 1995; Emerson and Souza 2003). How might trade policy affect work and schooling activities of children? In theory, the allocation of a child's time between work, school and leisure can been seen as the result of a household maximization problem subject to a budget constraint and constraints on the use of a child's time (Kis–Katos and Sparrow 2011). The head makes the decision based on the household's standard of living, the net returns to education, utility derived from the child's leisure and the child's contribution to the household income (Edmonds 2007). Thus, trade policy can influence the allocation of children's time by affecting any of the aforementioned determinants.

The relation between a household's standard of living and child labour has received considerable attention in the literature. Many theoretical models are based on the 'luxury axiom' presented in Basu and Van (1998), which implies that child labour is a bad in parental preferences. In this model, parents only send their children to work if the threat of poverty forces them to.[3] Thus, increased trade exposure is expected to decrease (increase) child labour if it benefits (hurts) the poor. Neoclassical trade

3 Basu and Van (1998) distinguish between work and 'non-work', which can include, for example, leisure or education.

theory provides insight into the effect of trade policy on a country's income distribution. Based on the Heckscher–Ohlin (HO) model and the closely linked Stolper–Samuelson theorem, trade liberalization has been commonly expected to mitigate poverty in developing countries. This prediction is based on the observation that developing countries have an abundant supply of unskilled labour—the group that is most likely to face poverty. The HO model suggests that a reduction in tariffs on import-competing goods will decrease the price of these goods relative to the exportables. This will induce a production shift towards the export sector. Since unskilled labour, due to its relative abundance, is used intensively in the production of the exportable, the shift in production raises demand and consequently wages for unskilled workers and thus reduces poverty (Bhagwati and Srinivasan 2002; Kis–Katos and Sparrow 2011).

It is important to note that this simplified line of reasoning ignores several features of international trade. First, an important assumption underlying the above analysis is that developing countries are relatively more abundant in unskilled labour in comparison to the countries they trade with. Yet, developing countries such as Brazil might face nations that have a greater endowment of unskilled labour. As a result, following predictions of the HO model, trade liberalization could have a poverty increasing effect for unskilled workers in certain countries. Second, trade often produces losers and winners. Predictions of the 'Specific Factors Model' developed by Paul Samuelson (1971) and Ronald Jones (1971) suggest that immobile factors in the import-competing sector will lose from trade in the short-run. Workers in these sectors might need time to transition to the expanding export sector and are therefore not perfectly mobile in the short-run. Thus, trade-induced employment reductions in the formerly protected industries can cause surges in unemployment, resulting in a decreased standard of living for these workers. If decreases in the standard of living are large enough such that it results in poverty, then this has the potential to increase the incidence of child labour following the 'luxury axiom'. Similarly, the HO-model predicts that factors of production used intensively

by the import-competing sector (e.g. skilled workers) are harmed by increased trade exposure even in the long run. Consequently, while workers in the exporting sector tend to be the beneficiaries, certain groups can be severely harmed by increased trade exposure. Thus, the effects of trade reforms on children that are a result of changes in a households' standard of living can be ambiguous, in particular in the short-run.

Theoretical models that consider deviations from the 'luxury axiom' suggest that, even in the simplest version of the Stolper–Samuelson reasoning, no clear predictions can be made of the effect of trade reforms on child labour. This is because the resulting income and substitution effects point in different directions (Kis–Katos and Sparrow 2011). A model developed by Fan (2011) assumes that the 'luxury axiom' only holds when adults' wage rate is so low that households face a subsistence constraint in consumption. In this income range children's working time decreases as parents' income rises. However, once adult wages exceed a certain threshold, Fan (2011) suggests that the substitutability between child and adult labour might become the main determinant of child work. Thus, if trade reduces poverty in developing countries due to a rise in unskilled wages, then this also increases the income opportunities for children and potentially child labour. Furthermore, the resulting fall in the economy's skill premium due to trade liberalization could reduce the expected net return to education since future income for skilled workers will be lower. In turn, this could result in lower school attendance.

While Basu and Van (1998) focus on the distinction between work and non-work, others have more closely examined the relationship between child labour and human capital investments. Schultz (1960) theorized that parents weigh the return on a child's education against its foregone wage income, emphasizing the trade-off between child labour and schooling. Baland and Robinson (2000) analyze whether child labour is socially inefficient. For this they focus on the impact of a child's labour on its future earning ability as an adult. Child labour might impair this ability due to increased health hazards or the loss of formal education

if the child's time constraint does not permit a combination of labour and school. Additionally, the authors point out that child labour can consist of salaried work outside the household but also of domestic tasks. If the majority of a child's time is consumed by domestic tasks such as work on a family farm, then this could also result in a lack of social and cognitive skills (Baland and Robinson 2000). Consequently, trade liberalization can have long-lasting effects on a country's potential growth through its impact on child labour and its link to human capital. Ranjan (2001) develops a model in which parents have to decide to either send their children to work or school and child labour arises due to credit constraints. In her model, trade liberalization could affect child labour and schooling through the effect on poverty in the presence of schooling costs (e.g. tuition, textbooks etc.). If, for example, poverty were to increase as a result of trade exposure, children's school attendance would decrease to save schooling costs and parents would instead send their children to work.

An important assumption underlying the models presented in Schultz (1960), Baland and Robinson (2000) and Ranjan (2001) is that work and school are mutually exclusive. To allow for a more realistic picture of the opportunity cost of a child's time in non-income uses, the model in Fan (2011) incorporates child labour, education and leisure in the same framework. This is especially important given that most household surveys capture a significant number of 'idle' children (i.e. children that neither work, nor attend school) (Edmonds, 2007). According to Edmonds (2007), "idleness can be fully rational in a time allocation model with schooling costs..." This also opens up the possibility that increased earning opportunities as a result of trade liberalization that raise children's time devoted to labour may come out of leisure instead of schooling and vice versa. Moreover, if parents value children's leisure highly enough, then a decrease in the household's income in response to increased trade exposure might result in lower school attendance to save schooling costs. However, at the same time this need not imply a rise in child labour but could instead result in more leisure time. Overall, theoretical work does not seem to offer clear predictions on the relationship between

trade policy and children's labour and school attendance. As the theoretical literature suggests, the effects depend on several mechanisms such as the relative magnitude of the resulting substitution (through changing wages) and income effects (through a change in the standard of living) and the importance of parental preferences. Thus, the question of how trade reforms affect a child's use of time has to be assessed empirically. The pioneering theoretical work on trade, child labour and human capital coupled with newly available nationally representative household surveys in developing countries have spurred a large wave of empirical studies on these topics.

Despite the HO-model's profound influence of economic thought regarding the distributional effects of trade reforms, empirical evidence on its predictions are indecisive (Gaddis and Pieters 2012). In Goldberg and Pavcnik (2007)'s discussion of recent empirical research, the authors conclude that globalization seems to have been correlated with an increase in inequality (measured by the wage gap between skilled and unskilled workers, i.e. skill-premium) in most developing countries. Indeed, they find little empirical support of labour reallocation across sectors in response to trade as noted by traditional models. Harrison (2007) reviews recent studies that have analyzed the effects of globalization on poverty in developing countries. One of the broad themes that emerge from her comprehensive discussion is that "the poor in countries with an abundance of unskilled labour do not always gain from trade reform." According to Harrison (2007), one of the reasons why predictions of the HO-model fail to hold in practice at times is that "labour is not nearly as mobile as the HO trade model assumes." Furthermore, trade may have failed to eradicate poverty and inequality because, prior to trade liberalization, highly protected sectors in developing countries often consisted of industries that used unskilled labour intensively (e.g. textiles and agriculture) (Harrison 2007). Accordingly, in certain Latin American countries including Chile, Colombia and Mexico, tariffs were higher for industries intensive in unskilled labour prior to trade reforms. Thus, a fall in the relative price of goods produced in these sectors as a result of tariff reductions,

followed by a fall in real wages for unskilled workers and an increase in poverty, would align with the Stolper–Samuelson theorem (Ferreira et al. 2007).

Brazil is an exception among South American countries. Tariff rates were higher for skill-intensive industries (i.e. manufacturing) prior to liberalization and studies provide evidence that skilled workers in Brazil have gained the least from increased trade exposure (Ferreira et al. 2007). In particular, recent work finds that trade reforms have significantly contributed to a reduction in wage inequality through a fall in the skill- premium (Gonzaga, Menezes Filho and Terra 2006; Ferreira et al. 2007). Hence, in terms of decreasing wage inequality, the Brazilian case seems to be in line with predictions of the HO trade theory. However, Menezes–Filho and Muendler (2011) observe that, while Brazilian trade reforms triggered worker displacements, especially from formerly highly protected industries, "neither exporting firms nor comparative-advantage industries [absorbed] trade-displaced workers for several years." Instead, increases in unemployment and informal employment are observed (Castilho et al. 2012) and "exporters [separated] from significantly more and [hired] fewer workers than the average employer" (Menezes–Filho and Muendler 2011). In addition, Castilho et al. (2012) find that urban areas in Brazil that experienced larger reductions in tariffs have seen smaller decreases in poverty in response to trade liberalization. They argue that this is because urban workers are largely employed in skill-intensive industries. These industries experienced the largest tariff reductions, resulting in unemployment spells. However, contrary to the observed fall in wage inequality discussed above, they find that inequality (measured by the Gini index) in these areas has also decreased less.

Whether the observed changes in poverty and inequality in response to trade reforms have affected child labour and schooling in Brazil depends on the importance of living standards as determinants of the use of a child's time. While theory generally assumes a strong link between poverty and child labour/schooling, empirical work offers no clear evidence. Canagarajah and Nielsen (2001) provide a review of some case studies of Côte

d'Ivoire, Ghana and Zambia that examine the determinants of child labour. The authors conclude that the empirical studies "cast doubt about the traditional, simplistic view that poverty is the main factor, which pushes African children into the labour market." While there generally seems to be a statistically significant relationship, the magnitude of the effect is moderate. However,in a separate study on Ghana, Canagarajah and Coulombe (1999) find that, "poverty is significantly correlated with the decision to send children to school..." In the case of Brazil, a study shows that programs between 1996 and 2001 involving income transfers conditional on the requirement that children attend school seemed to have had no significant effect on child labour, while the likelihood of children attending school increased (Bourguignon, Ferreira, and Leite 2002; Cardoso and Souza 2004). One exception was a program aimed at eradicating child labour in poor rural states of Northeast Brazil (PETI) implemented in 1996 that "increased time in school [and] reduced labour force participation and hazardous work" (Yap, Sedlacek and Orazem 2002).

As outlined in Rickey (2009), studies on rural Colombia (Cartwright 1999) and Paraguay (Patrinos and Psacharopoulos 1995) have estimated a positive relationship between child labour and income. Bhalotra and Heady (2003) make a similar observation in rural Pakistan and Ghana during the 1990s, where children of wealthy landholders were more likely to work than children from poor landholders. Because these observations undermine the 'luxury axiom', Bhalotra and Heady (2003) coined it the "wealth paradox" (Fan 2011). This paradox gave rise to Fan (2011)'s assumption that the substitutability between child and adult labour might become the main determinant of child work after a certain income threshold, as discussed earlier. Another possible explanation is that richer households tend to own more land but because of, for example, geographical inaccessibility to workers in certain areas, landholders find it cheaper to hire family members (Rickey 2009). Thus, wealthier households have more working children on average. In contrast, studies on Vietnam (Edmonds 2005) and Ecuador (Schady and Araujo 2006) observe

a negative relationship between income and child labour (Rickey 2009). Rickey (2009) further examines several studies on the poverty-schooling link in developing countries such as Pakistan (Ray 2000), India (Cigno, Rosati, and Tzannatos 2001), and Peru (Ilahi 2001) and concludes that income generally seems to have a larger effect on schooling than on child labour. Thus, even if trade reforms affect poverty and/or inequality levels in a country, the effect this has on child labour/schooling might not be as clear-cut as theory often assumes. The aforementioned "wealth paradox" is also a central feature of the Brazilian distribution of child labour. The paradox arises from the observation that Brazil's Southern region has one of the highest incidences of child labour in the country. Given that the South is the country's second richest region (after the Southeast), many studies have analyzed the relationship between child work and labour market conditions in Brazil, finding that the incidence of child labour tends to be procyclical and is more severe in regions with better work opportunities (Manacorda and Rosati 2010). This finding is in line with Brown, Deardorff and Stern (2002) who present an overview of the current literature concerned with the determinants of child labour. They conclude that, "while it is clear... that poverty increases the incidence of child labour it is also the case that child labour surges when employment opportunities present themselves." This provides further support for the substitutability-assumption in Fan (2011). Thus, it is not unlikely that if unskilled wages were to increase as a result of trade liberalization, then this could cause an increase in the incidence of child labour, in particular in Brazil as the above findings by Manacorda and Rosati (2010) illustrate.

Given the many channels through which trade reforms can work, direct empirical evidence is required to identify the impact of trade liberalization on child labour and schooling. However, evidence on the subject is scarce. Using cross-country data, Cigno, Rosati, and Guarcello (2002) and Edmonds and Pavcnik (2006) find that exposure to international trade seems to lower the incidence of child labour in developing countries on average. Edmonds and Pavcnik (2006) argue that this relationship seems

to be driven by a positive effect of trade on income. In contrast, Kis–Katos (2007) finds that trade-induced reductions in child labour are smaller among the poorest food exporting countries. According to Kis–Katos (2007), the income gains from trade for the poorest families might not be large enough to induce them to withdraw their children from work.

Other empirical studies have analyzed the effects of trade liberalization on either child labour or schooling using household-level micro data. Edmonds and Pavcnik (2005b) find that rice price increases in Vietnam during the 1990s, as a result of a dismantling of export quotas, caused a decrease in child labour. According to the authors, favorable income effects on net producers of rice account for their results. Similarly, Kis–Katos and Sparrow (2011) find reductions in the incidence of child labour in response to trade liberalization in Indonesia. The largest decrease is observed for children from low-skill backgrounds. As in Edmonds and Pavcnik (2005b), a favorable income effect on the poor due to trade liberalization seems to be the underlying mechanism driving these results (Kis–Katos and Sparrow 2011). In contrast, Edmonds et al. (2010) find that in rural India districts that have been more strongly exposed to trade liberalization have experienced smaller increases in schooling. Based on Topalova (2005), who shows that rural Indian districts more exposed to tariff reductions have seen smaller reductions in poverty levels, Edmonds et al. (2010) argue that families in these districts reduced schooling, in particular for girls, to save schooling costs. Likewise, Atkin (2012) suggests that trade reforms led to an increase in school dropouts in Mexico. Local expansions in export manufacturing increased employment opportunities for low skilled workers, which raised the opportunity cost of schooling (Atkin 2012). The mixed and relatively limited evidence highlights the importance of analyzing this issue in other developing countries. This paper attempts to contribute to the empirical discussion by examining the effects of trade liberalization on child labour and schooling outcomes in Brazil, one of the most inegalitarian countries in the world.

III. DATA AND DESCRIPTIVE EVIDENCE

A. DATA SOURCES

The data used in this study come from two different sources. Individual and household level micro data were drawn from the Brazilian National Household Sampling Survey (PNAD), which is conducted annually by the Brazilian Census Bureau (IBGE) sampling between 300,000 and 350,000 individuals every year.[4] PNAD data was obtained from the Brazilian Center for Metropolitan Studies (CEM). The survey is representative of the entire country, except of the rural North, which did not participate until 2003.[5] Brazilian states are matched across years providing a geographical panel dimension of the data. The PNAD provides information on child work, school attendance and socio-economic characteristics that can be used to construct individual and household-level control variables such as a child's gender, age and ethnicity, the household head's gender, age, literacy status, sector of employment and level of education, and the household's area of residence (urban or rural). I focus my analysis on children aged 10 to 14, as data on children younger than ten is not consistently available throughout the period of analysis. Furthermore, international conventions on child labour typically consider 15 the "Basic Minimum Age" at which a child is allowed to work.[6]

The outcome variables are defined as follows: children are considered working if they report work as their principal activity in the week preceding the survey. A child "attends school" if she/he reports attending school regardless of her/his principal activity. Work refers to both paid and unpaid,

4 For the period of analysis (1990–1995), PNAD data is not available for the census year 1991 and for the year 1994 due budgetary reasons.

5 Thus, not included in the analysis are the rural areas of the following six Northern states: Acre, Amapá, Amazonas, Pará, Rondônia, and Roraima. According to census data, these areas represent about 2.3% of the Brazilian population (Castilho et al. 2012).

6 See for example Convention No. 138 on the Minimum Age for Admission to Employment, 1973 developed by the International Labour Organization (ILO).

family and non-family labour but excludes household chores.[7] While I focus my analysis on the period 1990 to 1995, during which genuine trade liberalization took place, I present data on child outcomes for a more extensive period (1987–1998) so as to compare trends in child work and school attendance during the period of trade reforms with pre and post-reform trends. For the main period of analysis (1990–1995), the sample consists of about 150,000 children over four waves. Approximately 75% of these children reside in urban areas and the remaining 25% live in rural areas. Chart 1 provides pooled summary statistics of all outcome and control variables (for 1990–1995) that will be used in the regression analysis. All means are weighted to be nationally representative.

The second source consists of data on nominal tariffs and effective rates of protection (ERP) for the 1987 to 1998 period for 31 industry sectors. These data come from Kume et al. (2003), as reported in Abreu (2004). Nominal tariffs will be considered the main indicator of trade policy change. I thereby follow convention in the micro empirical literature on the effect of tariff reductions (see for example Topalova 2005; Edmonds et al. 2010; Kis–Katos and Sparrow 2011; Castilho et al. 2012). However, I repeat the analysis using effective rates of protection to establish the robustness of the estimated effects (see Section V).

B. DESCRIPTIVE EVIDENCE

Trade reforms in Brazil

Before trade reforms were implemented in the late 1980s, Brazil had followed a century-long strategy of import substituting industrialization (ISI) marked by a very restrictive and complex trade regime including extremely high tariffs and nontariff barriers (Castilho et al. 2012). While this strategy was accompanied

7 The IBGE altered the definition of work applied to the PNAD in 1992: Before 1992, the survey did not count as workers those devoted to unpaid labour of 15 hours per week or less and those devoted to the production for their own subsistence or to the building of their own home (see Silva and Grossi, 2000 for a more detailed discussion). To make data consistent over time, I exclude child workers falling into one of these categories starting in 1992.

by strong economic growth for long periods of time, in particular between 1930 and 1970, Brazil experienced a severe financial crisis during the 1980s known as "La Década Perdida" (The Lost Decade). Large amounts of international borrowing in response to the oil shocks of the 1970s and slow economic growth during the early 1980s resulted in severe macroeconomic instability and a balance of payment crisis (Kovak 2013). The government's confidence in the autarkic model declined as protectionism no longer generated sufficient economic growth (Abreau 2004). The government responded to the crisis by adopting liberal economic policies. It is important to note that, although the fundamental reversal in trade policy in the late 1980s was driven by internal events, Brazil's trade reforms also had external roots. Namely, they were implemented in accordance with multilateral negotiations under the Uruguay Round (Castilho et al. 2012).

Beginning in late 1987, the government proposed sharp tariff reductions and the removal of non-tariff barriers. Trade reforms started in 1988 with the first wave of tariff reductions (1988–1989) reducing average nominal tariffs from 58.2% to 32.1% while average effective rates of protection (ERP) decreased from 77.1% to 46.5% (see Figure 1). This first wave of reforms was aimed at removing tariff redundancy, which were primarily the result of an extensive system of special customs regimes (Kovak 2013).[8] Thus, initial tariff reductions had little impact on the actual level of protection and consequently on the behavior of producers. In 1990, following the removal of tariff redundancy, the remaining non-tariff barriers and special customs regimes were replaced with tariffs that provided the same levels of protection (Kovak 2013). At this point, tariffs became the primary instrument of protection and reflected the actual level of protection—measured as the difference between domestic and international prices. Similar to Kovak (2013) and Gaddis and Pieters (2014), I consider 1990 as the base year in my

8 According to Kovak (2013), 69% of imports benefited from one or more special customs regimes between 1977 and 1985.

analysis as tariff reductions became effective from 1990 onward.[9] The second and third wave of tariff reductions reduced average tariff rates to 13.5% in 1993 and 11.2% in 1994 (Abreau 2004). 1994 was followed with a modest reversal in trade liberalization mainly for the purposes of macroeconomic adjustments with relatively stable tariff levels following 1995. As in Kovak (2013), I consider 1995 the end of trade liberalization. Thus, the 1990–1995 period represents this paper's period of analysis.

Figure 2 depicts the tariff protection structure by sector for the 1990–1995 period indicating that trade reforms not only led to greatly reduced average nominal tariffs but also to more uniform rates by decreasing tariff dispersion across industries. The sectors with the highest nominal rates in 1990, such as the automobile industry, experienced the largest tariffs cuts in subsequent years. In contrast, sectors that had low initial tariffs, such as mining sectors, saw the smallest reductions in tariffs between 1990 and 1995. The agricultural sector—a strategic sector for Brazil's economic growth—was the only sector in Brazil's economy where the average nominal protection level in 1995 was higher than in 1990.

Labour Supply and School Attendance of Children in Brazil

Figure 3 depicts trends in child labour for the whole sample and separately for boys and girls. While overall child labour fluctuated between 1987 and 1990, it decreased steadily (but gradually) thereafter. The downward trend accelerated in 1992 with the largest dip occurring in 1996. In 1997, the downward trend saw a modest reversal but child labour started to decline again thereafter. Overall, child work decreased from 17.8% in 1987 to 11.1% in 1998 with the sub-period of trade liberalization accounting for about 2% of the decline (17.1% in 1990 to 15.0% in 1995). The dip in 1996 might be partially caused by government policies aimed at eradicating child labour in poor rural states

9 Further evidence that genuine trade liberalization did not begin until 1990 is provided by Kovak (2013) who finds that "tariff changes between 1987 and 1990 have no relationship to Brazilian wholesale price changes during that period, while subsequent tariff changes between 1990 and 1995 exhibit a strong positive relationship to prices."

of Northeast Brazil (PETI) that were initiated in 1996 as discussed in Section II. In 1987, the probability of a boy working was 24.6%—boys were more than twice as likely to work compared to girls (10.9%). While this gap decreased over time, it was still considerable in 1998 amounting to 8.5% (Figure 3). Boys were not only more likely to work but they also had a lower probability of attending school between 1987 and 1998 (Figure 4). However, for both genders school attendance increased steadily over time. During the period of trade liberalization, the probability of a child attending school increased from 83.9% to 89.8%. While boys were more likely to work than girls in general, it seems to be the opposite case for hours worked per week (Figure 5).[10] Overall, the amount of hours worked per week has decreased steadily from 35 hours in 1990 to 30 hours in 1995. Nevertheless, girls worked on average more than boys over the whole sample period.

In addition to gender disparities, large differences arise between different age groups. As figures 6 and 7 indicate, in 1987, 12–14 year old children had a higher probability of working and a lower probability of attending school compared to 10–11 year olds. While the gap in school attendance essentially receded over time, the difference in work probability still amounted to more than 9.5% in 1995. Disparities between areas are even more drastic (Figure 8 and 9). Not only has a rural child been on average more than three times as likely to work compared to a child residing in urban areas, but children in these two areas also experienced very different paths, in particular during the period of trade reforms. While the share of urban working children gradually decreased between 1990 and 1995, the rural share first increased dramatically, reaching its peak in 1992 at approximately 37%. After 1992, the rural share began to decrease but consistently stayed at much higher levels than the urban share. There have also been visible disparities in school attendance across rural and urban areas. However, while the difference amounted to almost

10 Note that Figure 5 includes hours of working children only (i.e. ≥ 1 hour for remunerated jobs and ≥ 15 hours for non-paid work).

19.0% in 1990, it sharply decreased to 10.5% in 1995. The fact that rural child labour is generally much higher than urban child labour is most likely due to higher living standards in urban areas. According to Manacorda and Rosati (2010), another reason why urban child work is lower on average is that "that urban boys are not able to combine a flexible work schedule on the household farm with school attendance, one option likely to be pursued by rural children."

From Figure 10 it is evident that there have been considerable regional disparities in child labour across Brazil, in particular between the Southeast and the rest of the country.[11] Additionally, while the Southeast, South and Midwest show a steady downward trend in child labour, the North and Northeast—the poorest regions of Brazil—first saw an increase in child work before it started to decrease around 1993. Interestingly, in 1987 the South of Brazil had a higher share of working children than the Northeast. While extreme poverty is a plausible determinant of child labour in the Northeast, this relationship does not arise in the South (the second wealthiest region of Brazil). As pointed out earlier, research has found that the large incidence of child labour in the South is likely due to better work opportunities for children (Manacorda and Rosati 2010). Accordingly, the Northeast and South show also lower school attendance in the pre-reform period compared to the other regions (Figure 11). These prior gaps, however, became almost non-existent by 1998 when all regions had achieved very similar enrolment rates.

Figures 12 and 13 depict changes in the work sector of children between 1987 and 1998 for urban and rural areas, respectively. In urban areas, the service sector seems to account for the bulk of working children (around 70% on average) followed by the manufacturing and agricultural sector with approximately equal shares. These sector shares stayed relatively constant in the period under consideration. A very different distribution of child labour across sectors is evident in rural areas. Here, most children are

11 Note that the incidence of child work in the North is underrepresented since rural areas in that region were not covered by the PNAD until 2003 as mentioned earlier.

active in the agricultural sector, which exhibits small fluctuations over time including a gradual but constant increase during the period of trade liberalization.[12]

Figures 14 and 15 show the different formality categories of working children in their respective occupations for urban and rural areas. While about 64% of urban working children work in formal or informal employment (renumerated)[13], the majority of rural working children have unpaid jobs (76% on average). The share of unpaid workers has increased in both rural and urban areas over time. Figure 16 analyzes different combinations of school and work. Between 1990 and 1995, the share of children only attending school has steadily increased (74.2% to 78.6%), while the probability that a child only works has decreased (7.4% to 3.9%). During the same period, children have become more likely to combine work and school (9.7% to 11.2%), while the share of 'idle' children has decreased accordingly from 8.8% to 6.4%.

IV. EMPIRICAL STRATEGY

A. MEASURING TARIFF PROTECTION

Following recent studies on trade liberalization (see for instance, Topalova 2005; Edmonds et al. 2010; Kis–Katos and Sparrow 2011; Gaddis and Pieters 2012), I construct an employment-weighted regional exposure of trade reforms. This measure called *ITE* (inverse trade exposure) combines time-varying industry level nominal tariff rates with pre-reform geographic concentration of industries within Brazilian states (with a distinction between in-state rural and urban areas). It is constructed as follows:

$$ITE_{ast} = \frac{\sum_i (L_{ias}1990 \times Tariff_{\text{it}})}{L_{as1990}}$$

12 Note the sharp increase of the agricultural share between 1990 and 1992 which directly relates to the observed spike of child work at the same time depicted in Figure 7 as discussed above.

13 Unfortunately, no consistent distinction can be made between informal and formal employment over the years. The category "informal employment" was included only from 1992 onwards.

where a denotes the area (urban or rural), s the state, i the industry, and t the year. $Tariff_{it}$ refers to the nominal tariff rate in industry i for year t, $L_{ias1990}$ to the workers employed in industry i, area a and state s in the year 1990. L_{as1990} measures the total workers employed in area a and state s for the year 1990. Thus, ITE_{ast} indicates how changes in exposure to tariff reductions vary by geographic area over the period 1990 to 1995 based on pre-reform distributions of employment. It is constructed as an inverse measure of trade exposure such that a high value indicates a high level of protection (and thus a low level of trade exposure).

Using pre-liberalization employment shares ensures that changes in the tariff measure within states over time reflect changes in tariff rates only. Thus, the measure acts as a proxy for cross-sectional variation in exposure to trade reforms for the period 1990–1995. Data on employment by industry, area and state for the year 1990 were drawn from the PNAD. The construction of ITE_{ast} necessitated a concordance between the two datasets given different industry classifications. Thus, I used the industry concordance match developed by Ferreira et al. (2007) to match the data on nominal tariffs (similar to the Nivel 50 classification) and employment (in the PNAD classification). The final industry classification consists of 22 industries (including the non-traded sector).

To be able to compute ITE_{ast}, an assumption has to be made regarding the non-traded sector. Previous empirical studies of trade liberalization have applied two different approaches (see for instance, Topalova 2005; Hasan, Mitra and Ural 2007; Edmonds et al. 2010; Cain, Hasan and Mitra 2010; Kovak 2013, Castilho et al. 2012; Gaddis and Pieters, 2012). One approach (Method I) is to assign zero tariffs to non-traded industries across all years while including workers in non-traded sectors when computing L_{as1990}. This approach assumes that prices in the non-tradable sector are unaffected by tradable sector prices reflecting the idea that states with larger shares of employment in non-traded industries (such as services and construction) are less severely affected by tariff reductions. By construction, ceteris paribus, states or areas with a large non-traded sector experience smaller

changes in the tariff measure.

Following predictions of the Balassa–Samuelson model, the second approach (Method II) includes workers in the traded sector only (such that employment shares sum to one over traded sectors), assuming that prices in the non-traded sector adjust proportionally and immediately to prices in the traded sector. This view is defended by Kovak (2013), who develops a specific-factors model of regional economies arguing that non-traded prices move with traded goods prices during liberalization. The treatment of the non-traded sector derives its importance from the contrasting results found by Topalova (2005) (applying Method I) and Hasan et al. (2007) (applying Method II) who find opposite effects of trade liberalization on poverty and inequality in India.[14]

While the first method potentially underestimates the effect of tariff reductions, it nevertheless seems more plausible since states with relatively large non-traded sectors are certainly less affected by tariff reductions compared to other states—at least in the short-run. The second method seems more appropriate for analyzing the long-term effects—once prices in non-traded sectors have adjusted. Given that this paper analyzes the short to medium term effects (i.e. benefits/costs) of trade liberalization, the first method will be the preferred measure. However, I will use the second approach to analyze whether the results using Method I hinge on the size of the non-tradable sector. Figure 17 depicts the trends of both tariff measures. Clearly, the measures express different extents of the tariff reforms. As explained above, Method I exhibits, on average, smaller changes in tariff reductions compared to Method II.

14 It is, however, unknown whether these contrasting findings are instead due to differences in the unit of analysis, time frame, or specification.

B. EMPIRICAL FRAMEWORK

Analysis

This paper analyzes the effects of tariff reductions on children's school attendance and labour supply in Brazil. The tariff measure exploits variation in (and changes in) tariff protection over time and over Brazilian states (and rural/urban areas within states) based on the composition of employment prior to trade liberalization. While the tariff measure provides a geographical panel nature, I estimate the effect of trade exposure at the individual level using pooled repeated cross-section data in order to maintain individual variation and to be able to control for individual and household level characteristics, detailed data of which is provided by the PNAD. The relationship between trade exposure and child labour/schooling is estimated using a linear probability model.

$$(1)\quad Y_{ihast} = \alpha + \beta ITE_{ast-L} + C_{ihast} + \gamma H_{ihast} + \delta U_{ihast} + \Omega_s + \mu_t + \varepsilon_{ihast}$$

where Y_{ihast} is an indicator for whether child i in household h, area a, state s at time t attends school/supplies labour. C_{ihast} is a vector consisting of individual-level controls including a child's age, gender and ethnicity. H_{ihast} includes household-level controls such as the household head's age, gender, literacy status, level of education (proxy for high- semi-or low-skilled labour) and main sector of employment. Furthermore, I include the indicator U_{ihast} for whether the household resides in an urban or rural area. ITE_{ast} is the trade protection measure lagged either zero years ($L=0$), one year ($L=1$) or two years ($L=2$), to account for the fact that the effects of reduced protection on child labour/schooling may or may not take time. In order to analyze whether the results hinge on the size of the non-traded sector, I estimate two different versions of [1]. The first scenario includes workers in the non-traded sector ($ITE\text{-}NT$), while the second version includes the traded sector only ($ITE\text{-}T$). Thus, β represents the main parameter of interest. The state fixed effects (Ω_s) control

for time-invariant unobserved regional heterogeneity, and thus I use within-state variation in tariff exposure to identify the impact of ITE on activity y. Year fixed effects (μ_t) control for aggregate time trends. I estimate the model for the whole sample as well as separately for girls and boys.

Potential Sources of Bias and further Specifications

For the coefficient β in [1] to reflect the causal impact of trade liberalization on a child's activity y, the tariff measure LIT must be uncorrelated with unobserved state-specific time-variant shocks ε_{ihast}. Since LIT captures the interaction of pre-reform industry employment weights and national industry-level tariffs, potential sources of bias can only arise from differential time-trends in child labour/schooling that are correlated with both the state's initial employment composition and changes in national tariffs (Edmonds et al. 2010). As discussed in Kovak (2013), there are a number of reasons to believe that this type of bias is unlikely to be a concern in the traded sector in the case of Brazil's trade reforms. There is general consensus that Brazil's trade liberalization during the early 1990s was driven by international trade agreements (Mercosur common external tariff) and that private sector groups appear to have had little influence on tariff reductions. According to Kovak (2013), Abreu (2004) and Kume et al. (2003), the sole goal was to decrease tariffs and to reduce variation in cross-industry nominal protection. As was shown in Figure 2, there is a strong correlation between an industry's 1990 tariff rate and its subsequent reduction. This implies that the tariff changes during liberalization were almost entirely determined by the pre-reform tariff levels (Kovak 2013).

However, as discussed in Section A, the tariff measure based on Method I is very sensitive to the share of people involved in non-traded industries. These industries are assigned constant tariffs of zero which do not change over time. This could confound the estimates if the initial size of the non-tradable sector has an impact on subsequent changes in child labour/schooling outcomes as discussed in Edmonds et al. (2010). To control for potential endogeneity, I instrument LIT-NT (LIT based on

Method I) with $LIT\text{-}T$ (LIT based on Method II) in specifications [2] and [3], as was done in Edmonds et al. (2010), Kis–Katos and Sparrow (2011), and Gaddis and Pieters (2012). $LIT\text{-}T$ is not mechanically affected by the size of the non-traded sector but both measures are strongly correlated.

$$(2)\quad Y_{ihast} = \alpha + \beta(ITE - NT = ITE - T)_{ast-L} + \pi C_{ihast} + \gamma H_{ihast} + \delta U_{ihast} + \Omega_s + \mu_t + \varepsilon_{ihast}$$

To allow for differential effects across urban and rural areas, I estimate a second specification in which I interact ITE_{ast-L} with a rural (R_{ihast}) and urban (U_{ihast}) indicator variable. Distinguishing between differential trade liberalization effects across urban and rural areas is particularly important given the very different distribution of work modality between these two areas. As shown in Section III, rural children tend to work in unpaid jobs, while rural children are much more likely to be (informally) employed. Thus, it could be the case that these children react differently to changes in, for instance, wages.

$$(3)\quad Y_{ihast} = \alpha + \beta_1 R_{ihast} \times (ITE - NT = ITE - T)_{ast-L} + \beta_2 U_{ihast} \times (ITE - NT = ITE - T)_{ast-L} + \pi C_{ihast} + \gamma H_{ihast} + \delta U_{ihast} + \Omega_s + \mu_t + \varepsilon_{ihast}$$

As discussed above, there is general consensus that the tariff reductions were exogenous to an industry's strength or competiveness and thus endogeneity is less likely to be a concern in the traded sector. However, despite this, Kovak (2013) does observe a negative correlation between the 1990–1995 tariff changes and the pre liberalization 1985–1990 growth in industry employment. This implies that industries that were growing more quickly during the pre-reform period of 1985–1990 subsequently experienced larger tariff reductions during the period of trade reforms (Kovak 2013). According to Kovak (2013), "this correlation would be consistent with strategic behavior in which the 'strongest' industries were allowed to face increased international competition." Thus, to

control for the possibility that state-specific omitted time-trends in child labour/schooling are correlated with both the state's initial employment composition and changes in national tariffs, I interact state-specific pre-reform employment conditions with year indicators to allow for different time trends in child activities across states based on initial conditions as proposed by Edmonds et al. (2010) and Gaddis and Pieters (2012). These initial conditions include the share of workers in a federal state employed in agriculture, manufacturing, other industrial activities, construction, commerce, services, and other activities.[15] Thus, differential trends in child labour/schooling driven by different local growth trajectories based on pre-reform conditions will be controlled for by $\delta E_{as} \times \mu_t$ — a vector of pre-reform state (and rural/urban specific) characteristics interacted with time dummy variables. The main specification of the paper thus becomes:

$$
\begin{aligned}
(4)\ Y_{ihast} = {} & \alpha + \beta_1 R_{ihast} \times (ITE - NT = ITE - T)_{ast-L} + \\
& \beta_2 U_{ihast} \times (ITE - NT = ITE - T)_{ast-L} + \\
& \pi C_{ihast} + \gamma H_{ihast} + \delta U_{ihast} + \delta E_{as} \times \mu_t + \\
& \Omega_s + \mu_t + \varepsilon_{ihast}
\end{aligned}
$$

The differential effects of tariff reductions are further analyzed by adding interactions of the tariff exposure with household characteristics (the education as well as main sector of employment of the household head) to specification [4]. The goal of policy makers to reduce cross-industry dispersion in tariff levels had as a result that skill-intensive industries generally experienced the largest tariff cuts. To analyze more closely the differential effects of tariff reductions across household groups of different skill-levels, I compute the tariff measures ($LIT\text{-}NT$ and $LIT\text{-}T$) in Section IV-A separately for 'skilled' and 'unskilled' households in each state. The skill-levels are based on the educational attainment of the head of household. 'Skilled' workers are those that have attended secondary school or higher, while 'unskilled'

15 These shares were calculated separately for urban and rural areas.

workers have attended *ensino fundamental* only (i.e. primary or middle school). I then estimate specification [4] separately for children living in 'skilled' and 'unskilled' households. To examine the effect of tariff reductions on child work in more detail, I also run specification [4] with the employment sector, employment modality and hours worked (per week) of children as the dependent variable. Moreover, I also analyze the effects of tariff reductions on different combinations of the outcomes of interest (i.e. work & school, work only, school only, 'idle'). As will be discussed in the next section, other robustness checks include the use of effective rates of protection (as opposed to nominal rates), and the omission of states that are considered potential outliers.

V. ESTIMATION RESULTS AND DISCUSSION

Table 1 provides estimation results for specification [1]. The coefficient on $ITE\text{-}NT$ estimates the effect of a 1% increase in the tariff measure on the dependent variable if the non-traded sector is included. $ITE\text{-}T$ excludes the employment shares of non-traded industries. Since $ITE\text{-}NT$ might suffer from omitted variable bias, the results should be viewed with caution. While $ITE\text{-}T$ is less likely to suffer from endogeneity, the coefficient on $ITE\text{-}T$ should be interpreted with the consideration that it tends to overestimate the extent of tariff reductions as discussed in Section IV-A.

With no lag, the results indicate that in response to tariff reductions, both female and male children were less likely to attend school for both tariff measures. However, the coefficient on $ITE\text{-}NT$ is more than twice as large in magnitude. While the effects of tariff changes measured by $ITE\text{-}NT$ completely wear off with a one-year lag, they return with the two-year lag specification but less significant and only for girls. The probability of a male child working has increased with a two-year lag for $ITE\text{-}T$ but is significant only at the 10% level. Table 1 in the Web Appendix provides an extended version of the estimation results of specification [1] (zero lags) including all the control

variables. Three noteworthy results emerge (all the other results had the expected sign). First, while a male child that identifies himself with being "white" is more likely to go to school than a boy from a different ethnicity, the same child does not have a lower probability of working.

Second, considering the effect of the household head's employment sector on a child working, it seems that children with the lowest probability of having a job are the ones whose parents are inactive. This could be an indication of a structural problem in these households. Lastly, as the coefficients on the year-dummy variables indicate, there seems to have been a national upward trend in schooling during the period of analysis, while no such trend is observed for child labour.

Table 2 provides the IV estimation results for the overall sample and for the interactions of the tariff measure with urban/rural dummies. *ITE-NT* is instrumented with *ITE-T* to control for possible endogeneity as discussed in Section IV-B. Both measures are strongly correlated both overall and in urban and rural areas (see Table 2 in the Web Appendix for First-Stage results). Similarly to the results in Table 1, I interpret the coefficients in Table 2 with caution as they too might suffer from omitted variable bias. With no lag, the results on schooling for *ITE-NT* remain robust but become larger in magnitude. Furthermore, schooling seems to have decreased in both rural and urban areas for both genders. With this specification, the probability of a child working in rural areas seems to have increased overall driven by the impact on male children. With a one-year lag the tariff reductions have led to a decrease in the probability of a child attending school overall and for female children. Child labour seems to have increased in urban areas with a one-year lag. With a two-year lag the negative effect on workers in urban areas becomes more significant for male children as opposed to the specification with a one-year lag. For girls, the negative effect of tariff reductions on school attendance also appears with a two-year lag.

Table 3 presents estimation results for specification [4]—the main specification of the paper. In addition to the IV control, I

estimate the model allowing for a different trend in child labour/schooling outcomes across states based on initial state conditions as discussed in Section IV-B. With zero lags, the effects of tariff reductions on schooling and work observed in Table 2 are *not robust* to this control in neither urban nor rural areas. The estimates have the same sign as before but have become statistically insignificant. Thus, it is likely that the observed immediate impact (i.e. zero lags) of tariff reductions in Table 2 was driven by unobserved state-specific time-trends that affected child labour/schooling and that are correlated with the tariff measure. Moreover, the lagged effects on child schooling and labour in urban areas are not robust to this specification either.

As Tables 3,4 and 5 in the Web Appendix show, the larger the employment shares of, for example, agriculture, manufacturing and services in 1990 relative to the initial construction share (the omitted category), the greater (smaller) the probability of a child working (attending school) in subsequent years. Since the endogeneity issue due to the non-traded sector is controlled for by the IV, it is likely that the tariff reductions were indeed correlated with time-varying state-specific omitted variables that affected the outcomes of child labour and schooling. However, after cleaning for endogeneity issues in the tariff measure, it seems to be the case that child schooling in rural areas with greater exposure to trade have more been negatively affected with a one-year and two-year lag in the tariff measure (significant at 10%). More specifically, in response to an exogenous 1% decrease in the tariff measure in rural areas, the probability of a girl attending school decreased by 5.5% with a one-year lag. Given an overall decrease of approximately 2% in the tariff measure in rural areas between 1991 and 1994, the results indicate that girls in rural areas have become about 11% less likely to attend school relative to the national trend.

Tables 6 and 7 in the Web Appendix provide estimation results for two robustness checks of specification [4]: Table 6 depicts results on child labour/schooling using effective rates of protection. Given that ERPs take into account input and output tariffs, they generally differ from nominal tariff rates. However,

both measures are highly correlated as evident in Figure 1. In Table 7, two potential outliers were dropped: Distrito Federal and Amazonas. According to Castilho et al. (2012), Distrito Federal (Brasília) is where the majority of national government activities are concentrated and it has a "very peculiar productive, labour, and revenue pattern compared with the rest of the country." On the other hand, Amazonas is considered a potential outlier because of the 'free trade zone' status held by the Manaus industrial area located in that state (Castilho et al. 2012). In Table 6, the negative effect on schooling for girls with a one-year lag becomes more significant but smaller in magnitude. Thus, the use of effective rates of protection as a trade policy measure does seem to make a small difference. However, the main results are robust to this alternative. That is, with a one-year and two-year lag, schooling for girls decreased by more in rural areas with larger exposure to trade compared to rural areas that experienced smaller tariff reductions. With potential outliers dropped, the effects remain robust (see Table 7 in the Web Appendix).

To allow for a more disaggregated analysis, Tables 4 (zero lags), 5 (one lag) and 6 (two lags) depict estimation results for the interaction of the tariff measure with the household head's level of education. In Table 4, significant negative effects on schooling are observed for girls in rural areas from high-skilled backgrounds (secondary school or higher). With a one-year and two-year lag, the probability of a girl in rural areas attending school has decreased for all educational backgrounds of the household head.

However, the effect is generally larger for girls from high-skilled backgrounds. With a one-year and two-year lag, boys in rural areas have also become less likely to attend school if the household head has attended middle or secondary school. Similarly, in urban areas for zero, one and two lags, school attendance has decreased for girls from higher educational backgrounds. However, the impact is generally larger and more significant in rural areas. The only significant effect on work occurs for boys in urban areas with no lag, if the household head has completed less than one year of primary school (no education).

Generally, the results indicate that the higher the educational attainment by the head of the household, the larger the negative effect of tariff reductions on child schooling. This result is in line with the finding by Gonzaga et al. (2006) and Ferreira et al. (2007) who observe a fall in the economy wide skill-premium as discussed in Section II. If educational attainment is a proxy for a worker's skills, then it is plausible that the fall in the skill-premium decreased incomes by more for workers with a relatively high education. If the fall in income was large enough to induce these families to take their children out of school to save schoolings costs, then this would explain the estimation results.[16] Girls seem to bear the burden of falling incomes disproportionately. The fact that, with a one-year and two-year lag, girls from low-skill backgrounds in rural areas have been negatively affected as well, could point to a general fall in the standard of living as a result of tariff reductions and the resulting fall in wages but more so for semi- to high-skilled households. The observed increase in work for boys from uneducated urban households could be the result of a poverty increase in urban areas as a result of tariff reductions, found in Castilho et al. (2012).

Table 7, 8 and 9 provide estimation results for the interactions of the tariff measure with the household head's main sector of employment. I distinguish between the three main sectors (agriculture, manufacturing, and services) and two other categories that include other unclassified activities and those inactive. The results indicate that the probability of a male child working has increased in urban areas in households specialized in agriculture and manufacturing for zero, one and two-year lags as a result of tariff reductions. With a one-year lag, the effect on a boy's labour from an urban-situated household specialized in agriculture is highly significant (at the 1% level) and agrees with the finding in Table 4, where child work increased for boys in urban areas from low-skilled backgrounds as a result of tariff reductions. Schooling has decreased in rural areas for girls from all household

16 Since public schools are funded by municipal and state governments in Brazil, schooling costs are more likely to be related to textbooks, tutoring, school uniforms etc. which can still be considerable.

backgrounds with a one and two-year lag. However, households specialized in skill-intensive sectors, such as the manufacturing and service industries seem to have experienced (slightly) stronger and more significant adverse effects than households specialized in agriculture. Yet, in the same industries no effect on schooling in urban areas is observed. In both urban and rural areas, schooling has decreased for girls living in households specialized in other activities (i.e. poorly defined or unstated activities). Generally, no significant effects are found for children living in inactive households. Thus, these households seem to be unaffected by changing prices and wages given their employment status.

To explore in more detail the observation that children from higher educational backgrounds (measured by education level of the head of household) have seen the smallest increases in school enrolment relative to the national trend as a result of tariff reductions, I independently compute the tariff measures for 'skilled' and 'unskilled' households. I then estimate specification [4] separately for children living in either 'skilled' (Table 10) or 'unskilled' households (Table 11), as outlined in Section IV-B. Table 10 shows that girls and boys from 'skilled' households have indeed seen a large decline (smaller increase) in the probability of attending school with a one and two-year lag. The results are generally highly significant (at the 1% level) and confirm that rural areas have seen larger declines in schooling compared to urban areas and that girls in rural areas have suffered the most from trade liberalization. With a one-year lag, for instance, the probability of a girl living in a rural situated household attending school has increased 3.2% [(0.07 - 0.038) × 100%] less in response to a 1% decline in tariff protection compared to a girl living in an urban area. For children from 'unskilled' households, the results generally indicate that for a one and two-year lag, schooling has increased and work has decreased. However, the results are statistically insignificant (Table 11). Thus, the increased working probability of urban boys living in households specialized in agriculture (mostly 'unskilled' workers) observed in Table 7 is not robust to this specification. As discussed in Section III, the agricultural sector, which accounts for the majority of 'unskilled'

workers, has been subject to only very small changes in tariff protection. Indeed, as evident in Figure 2, nominal tariffs in this sector have slightly increased between 1990 and 1995. Thus, it is not surprising that most of these workers have not experienced large effects of changes in tariff protection.

Overall, the results provide further evidence that children, in particular girls, from educated households or households specialized in skill-intensive industries have benefited the least from falling tariff protection, which is likely a result of decreasing wage inequality. The largest impact on school enrolment has arrived with a one-year delay. The fact that schooling in rural areas seems to have been more negatively affected than school attendance in urban areas could be an indication of a stronger standard of living-schooling link in rural areas. It is not unlikely that parents in rural areas in Brazil place less value on education than in urban areas. This could be a result of a significant difference in school quality between these two areas. The following excerpt of a publication by *World Education News and Reviews* in 1990 on Brazilian school quality supports this finding:

> Education in rural areas suffers by comparison with urban centers. Rural education is often marked by a shortage of schools or inferior facilities, which may consist of one-room schools for all grades, and a long tradition of inadequately trained teachers. At primary level about 14 percent of teachers have little or incomplete training. They are called "lay teachers," and most work in rural areas.

Thus, the net returns to education in rural areas, in particular during the early 1990s, were much smaller compared to urban areas due to school quality differences. This could imply that rural households were more likely to take their children out of school to save schooling costs as income fell, highlighting the importance of parental preferences and net returns to education as determinants of child schooling. Moreover, the fall in the skill premium could have reduced the return to investments in human capital. However, according to Kis–Katos and Sparrow

(2011), "technological upgrading is certainly an issue in the long run [which] gives an additional motive for human capital accumulation and makes the longer-term relevance of short-term falls in skill premia questionable." The finding of no simultaneous increase in work for these children has at least two potential explanations. Since children in rural areas generally work in the agricultural sector (see Figure 13), it may have been difficult for them to find a job seeing as the export sector (consisting mostly of the agricultural sector) contracted as a result of trade liberalization (Menezes–Filho and Muendler 2011). On the other hand, parents might simply value a child's leisure highly enough such that it outweighs the foregone economic contribution of the child (see Section II). The varying experiences by gender are counterintuitive seeing as parents in Brazil seem to value girls' education more highly than boys' education. Yet, girls' schooling has declined the most. Thus, school enrolment of girls seems to be more sensitive to changes in household income.

Alternative Measures of Work

Table 12 depicts OLS estimation results using hours worked (per week) as the dependent variable.[17] With zero and two lags, working hours in urban areas seem to have increased but no significant effect is observed in rural areas for the whole sample. However, boys have increased their working hours in rural areas with no lag included. With a one-year lag, no effect is observed. While previous results indicate that girls have not become more likely to work but on the other hand less likely to attend school, they do seem to have increased their working hours in urban areas. However, given the large share of children that report zero hours worked, these results should be interpreted with caution, as they are likely to be biased.

Tables 13 and 14 examine whether tariff reductions have caused changes in child employment levels across formality

17 Given that a large share of observations reports 0 h worked, other authors (see Edmonds and Pavcnik 2005b; Kis–Katos and Sparrow 2011) suggest using Tobit. However, adding fixed effects to a non-linear model generally results in inconsistent estimators. Thus, I will present OLS estimates only.

categories (i.e. employee, self-employed and unpaid) and sectors. The results suggest that in urban areas, working girls have become more likely to obtain either a formal or an informal employment status for zero, one and two lags, whereas in rural areas they have become less likely to be self-employed. The probability of being employed has increased for male children in urban areas as well (one and two-year lags). Given the large share of informal employment among urban working children,[18] these results most likely imply an increase in this formality category as a result of trade liberalization. Table 14 shows that there seems to be no significant change in the employment sector for working girls in rural areas but boys in rural areas have become less likely to work in the manufacturing sector and in "other activities" with no lag. The largest and most significant effect (at the 1% level) is observed in the service sector for male children in urban areas with no lag. In response to a 1% decline in nominal tariff protection, a boy residing in an urban household has become 1% more likely to work in the service industry. A similar but less significant effect is observed with a two-year lag.

Combinations of Work and School

Table 15 analyzes the effects of tariff reductions on different combinations of work and school. More specifically, I distinguish between children that combine work and school, children that either only work or only attend school and children that do neither, here referred to as 'idle'. For children that both work and go to school, the coefficients in both urban and areas for zero, one and two-year lags are all negative, however, none of them is statistically significant. With no lag, girls have become more likely to *work only* in both urban and rural areas and less likely to attend *school only* in urban areas as a result of tariff reductions. The latter effect also appears with a one-year and two-year lag and is larger in magnitude. While the coefficients have the same sign for boys and girls, the effects on boys are generally smaller and not statistically significant.

18 This observation is based on 1992–1995 PNAD data.

While, there seems to be no significant evidence that the probability of a child being 'idle' has changed, it is interesting to note that for a one and two-year lag, the coefficients for boys and girls have opposite signs. That is, boys have become less likely to be 'idle', whereas the probability of girls being 'idle' has increased.

VI. CONCLUSION

Theoretical and empirical work has long been concerned with the distributional effects of trade within developing countries. While standard trade theory is clear on the many long-terms gains of trade reforms, empirical research has increasingly focused on the short-term effects, in particular the costs borne by workers of formerly protected industries. Topalova (2005) and Castilho et al. (2012), for instance, link smaller decreases in poverty and inequality levels in India and Brazil to trade liberalization. However, it seems that the short-term effects are context-specific and depend on numerous country characteristics given the contrasting findings of various case studies (see for example, Suryahadi 2001 on Indonesia; Brandt and Benjamin 2004 on Vietnam; Goldberg and Pavcnik 2005 on Colombia; Topalova 2005 on India; Castilho et al. 2012 on Brazil).

Given that trade liberalization "is one of the most common policy prescriptions offered to initiate poverty eradication in today's developing countries" (Edmonds et al. 2010), the impact trade reforms have on children is of great public and political interest, in particular because child activities are directly linked to human capital accumulation and thus to growth and development in low-income countries. While several empirical studies have encountered a "wealth paradox", finding that wealthier households have more working children at times, child labour's close link to poverty remains undisputed (Kis–Katos and Sparrow 2011). Indeed, recent studies examining the effects of trade liberalization on child labour in Vietnam (Edmonds and Pavcnik 2005b), India (Edmonds et al. 2010) and Indonesia (Kis–Katos and Sparrow 2011), find trade-induced changes in poverty levels to be

the main determinant of changes in child labour and schooling outcomes in these countries. However, given the scarce evidence, it is important to analyze the subject in other developing countries.

This paper examined the impact of trade reforms on child labour and schooling outcomes in Brazil, which liberalized its economy in the early 1990s, marking the end of a century-long strategy of import substituting industrialization (ISI). The government's aim of reducing variation in cross-industry nominal protection, which had been considerable at the onset of trade reforms, combined with significant heterogeneity in the structure of production across Brazilian states provides a valuable basis for identifying regional effects of trade liberalization. The tariff measure exploits the large temporal and cross-regional variations in tariff reductions by combining pre-reform industrial composition of employment with temporal variations in tariff lines to measure the extent of trade exposure at state-level. Furthermore, detailed household data allows for the possibility to analyze the differential effects of trade liberalization on children from different socioeconomic backgrounds. However, this study did not explicitly identify the channels through which trade liberalization affected children in Brazil. Given this, this paper can only make suggestions regarding potential transmission mechanism based on the estimated results and findings of previous research on Brazil.

The estimated results show that states or areas with greater exposure to trade due to tariff reductions, exhibited smaller increases in children's school attendance relative to the national trend. Girls in rural areas from high-skilled backgrounds experienced the largest adverse effects. This finding is in line with recent research on Brazil that suggests that the skill-premium in the economy decreased as a result of trade reforms (Gonzaga et al. 2006; Ferreira et al. 2007). The differential effects across rural and urban areas (which also saw decreases in schooling but smaller in magnitude and less significant) are likely due to large differences in school quality between these areas. Thus, net returns to education are smaller in rural areas and parents presumably place less value on education. As a result, the poverty-schooling

relationship in the presence of schooling costs might be stronger in rural Brazil. There is only weak evidence that the incidence of child labour has changed in response to trade liberalization. While some results indicate that boys in urban from uneducated households have become more likely to work, this finding is not robust to the specification in which I construct separate tariff measures for 'skilled' and 'unskilled' workers.

Overall, the results highlight the importance of schooling determinants such as a household's standard of living, net returns to education and parental preferences. In addition, the differential effects between rural and urban areas, boys and girls, and different socioeconomic backgrounds emphasize the importance of distinguishing between these factors when analyzing the impact of trade liberalization in developing countries. However, further research is needed to identify the channels through which trade reforms affected children in Brazil as was done in Edmonds et al. (2010) in the case of India. The results of this paper further stress the importance of examining trade liberalization effects on children in other developing countries. While this paper, in addition to the studies by Edmonds et al. (2010) and Atkin (2012) observe adverse effects on schooling, the findings of decreasing child labour in Vietnam and Indonesia indicate that the impact of trade policy on children seems indeed to be context-specific. The smaller increase in school enrolment, relative to the economy-wide trend, in Brazilian states more exposed to tariff reductions can have significant consequences for long-run economic growth and thus has important policy implications. However, as noted above, this study is constrained by a limited number of cross-sections at state-level. Hence, further research could examine this subject using census data to analyze to what extent these estimation results suffer from insufficient variation.

Finally, there are two additional limitations to the data that should be highlighted. The lack of observations for rural areas in the Northern region might considerably affect the estimated results. The North is the second poorest region (after the Northeast) in Brazil and child labour is a common phenomenon in these areas. Thus, it is not unlikely that the estimated impact on child

labour and schooling in rural Brazil is biased due to the exclusion of the rural north. Additionally, household surveys such as the PNAD "inevitably [miss] children who do not live within the sampling frame, such as sex workers, trafficked children, bonded labourers, street children, and the homeless" (Edmonds et al. 2010). Similarly, data on children younger than ten is not available consistently throughout the period of trade liberalization. Hence, the PNAD does not capture the whole extent of child labour and school enrolment in Brazil. How these 'missing' children were affected by Brazilian trade reforms remains unknown.

IV

REFERENCES AND APPENDICES

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REFERENCES AND APPENDICES

STRUCTURAL ADJUSTMENT OR STRUCTURAL VIOLENCE?

EXAMINING EBOLA EPIDEMIC IN WEST AFRICA UNDER NEOLIBERAL POLICY

Riza Irhamni

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A PHILOSOPHICALLY INCONSISTENT THEORY

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APPENDIX 1

Testing for stationarity in the two-time series processes below can be achieved with an Augmented Dickey Fuller Test (ADF) with four lags:

TABLE 5
ADF TEST STATISTICS

Series	Test Statistic
REG_t	-2.30
$ln(carbon\ tax_t)$	-0.86

*NOTES: ** indicates a p-value <0.05 and * indicates p-value <0.1*

At the critical value of -2.86 at the 5% level, (Banerjee et al. (1993) as cited in Wooldridge (2003)) it can be inferred that there is no evidence to reject non-stationarity in either series, and, thus, REG_t may be susceptible to the spurious regression problem. An Engel Granger test for cointegration may now be used to examine the validity of any relationship between REG_t and $ln(carbon\ tax_t)$. We use an ADF test to find evidence for stationarity in the residual $\hat{u}_t$, where

$$\hat{u}_t = REG_t - \hat{\beta}_0 - \hat{\beta}_1 \ln carbon\ tax_t$$

If the test suggests stationarity in $\hat{u}_t$, then there is evidence for cointegration between REG_t and $carbon\ tax_t$, so a long run relationship likely exists. An Engel Granger test yields the following results:

TABLE 6
ENGEL GRANGER TEST STATISTICS

Series	Test Statistic
$\hat{u}_t$	-2.63

At the critical value of -3.78 at 5% (Davidson and MacKinnon (1993) as cited in Wooldridge (2003)) for a cointegration test, with a linear time trend, there is no evidence to reject the null hypothesis of a unit root process in the residuals. Thus, there is no evidence of cointegration between REG_t and $carbon\ tax_{BC,t}$, so no evidence for any long-run relationship.

APPENDIX 2

An Engel Granger test of Model 1 and Model 2 estimates the residuals below:

$$\hat{u}_{1,t} = \ln Q_{R,t} - \hat{\beta}_0 - \hat{\beta}_1 \ln carbon\ tax_t$$

$$\hat{u}_{2,t} = \ln Q_{N,t} - \hat{\beta}_0 - \hat{\beta}_1 \ln carbon\ tax_t$$

An Augmented Dickey Fuller Test of the residuals yields the following test statistics:

TABLE 7
ADF TEST STATISTICS

Series	Test Statistic
$\hat{u}_{1,t}$	-3.70**
$\hat{u}_{2,t}$	-5.40**

*NOTES: ** indicates a p-value <0.05 and * indicates p-value <0.1*

Considering the critical value of -2.86 at the 5% level (Banerjee et al. (1993) as cited in Wooldridge (2003)), it can be inferred that there is evidence to reject the null hypotheses that each residual process is unit root and therefore, there is evidence for cointegration.

WOMEN'S AUTONOMY IN RED INDIA

ASSESSING THE C.P.M. IN POWER

Roshak Momtahen

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OIL PRICE FLUCTUATIONS AND CANADA'S EXCHANGE RATES

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NO TWO EXPERIMENTS ARE IDENTICAL

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TRADE LIBERALIZATION, CHILD LABOUR, AND HUMAN CAPITAL INVESTMENTS IN BRAZIL

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APPENDIX

Charts

CHART 1
DESCRIPTIVE STATISTICS

Variable	Mean	Standard Deviation	Minimum	Maximum
Pooled				
Work	0.16	0.37	0	1
School	0.87	0.34	0	1
Work & School	0.11	0.31	0	1
Work only	0.05	0.23	0	1
School only	0.76	0.43	0	1
Idle	0.08	0.26	0	1
Hours worked	5.25	13.15	0	98
Employee	0.06	0.25	0	1
Self-employed	0.01	0.10	0	1
Unpaid	0.09	0.28	0	1
Works in agriculture	0.09	0.28	0	1
Works in manufacturing	0.01	0.12	0	1
Works in services	0.06	0.24	0	1
Works in other activities	0.00	0.03	0	1
Female	0.50	0.50	0	1
White	0.49	0.50	0	1
Age	11.98	1.41	10	14
Female head	0.15	0.36	0	1
Head: age	44.31	10.36	10	102
Head: literate	0.75	0.43	0	1
Head: no education	0.27	0.45	0	1
Head: attended primary	0.40	0.49	0	1
Head: attended middle	0.17	0.38	0	1
Head: attended secondary	0.09	0.29	0	1

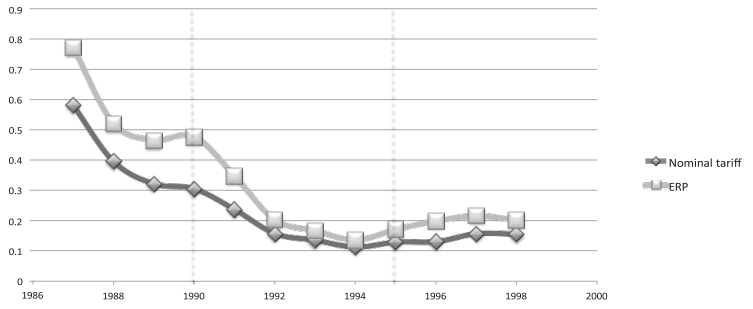
CHART 1
DESCRIPTIVE STATISTICS

Head: attended higher	0.06	0.24	0	1
Head: works in agriculture	0.25	0.44	0	1
Head: works in manufacturing	0.14	0.35	0	1
Head: works in services	0.46	0.50	0	1
Head: works in other activities	0.02	0.13	0	1
Head: inactive	0.13	0.33	0	1
Urban	0.75	0.44	0	1
LIT-NT	0.04	0.02	0.01	0.10
LIT-T	0.13	0.07	0.04	0.32
ERP-NT	0.04	0.03	0.01	0.16
ERP-T	0.16	0.11	0.02	0.51
Agricultural share	0.21	0.28	0.01	0.82
Manufacturing share	0.15	0.08	0.03	0.27
Construction share	0.06	0.02	0.01	0.11
Other industry share	0.01	0.01	0.00	0.08
Commerce share	0.13	0.06	0.02	0.21
Services share	0.40	0.15	0.08	0.66
Other activities share	0.03	0.02	0.00	0.06

Notes:
Observations for each variable are 150066.
LIT-NT refers to the tariff measure that is based on nominal tariffs and includes the non-traded sector.
LIT-T refers to the tariff measure that is based on nominal tariffs and excludes the non-traded sector.
ERP refers to effective rates of protection.
The sector shares reflect pre-reform (1990) employment shares.
All means are weighted to be nationally representative.

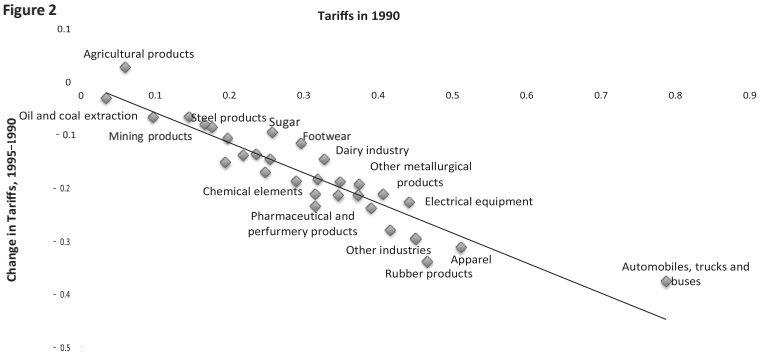
Figures

Figure 1



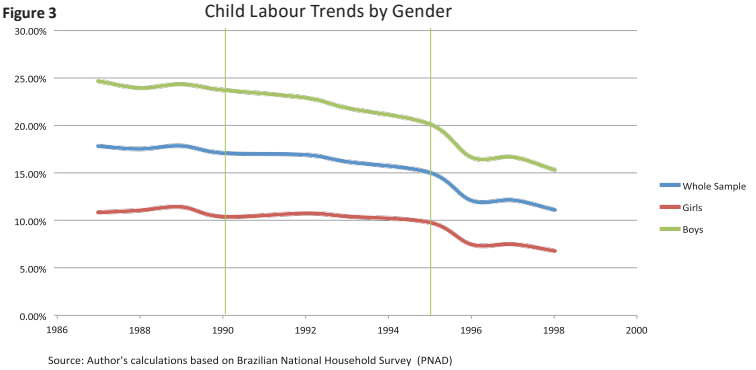
Source: Author's calculations based on data from Kume et al. (2003) as reported in Abreu (2004)

Figure 2



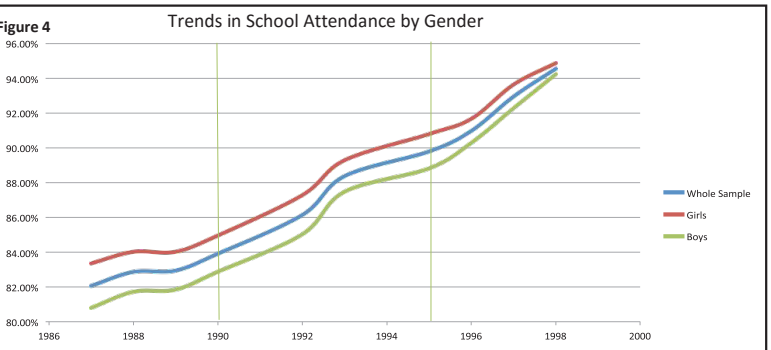
Source: Author's calculations based on data from Kume et al. (2003) as reported in Abreu (2004)

Figure 3



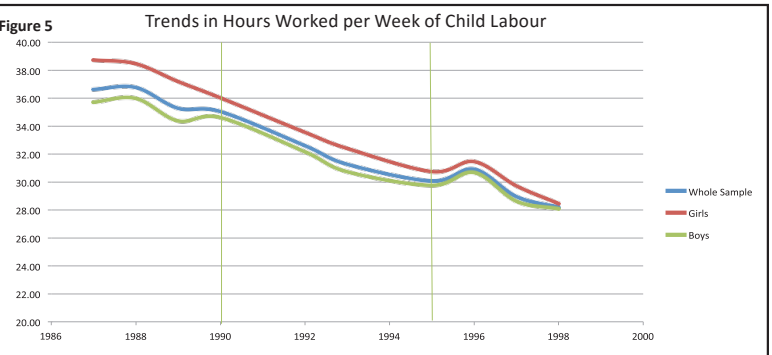
Source: Author's calculations based on Brazilian National Household Survey (PNAD)

Figure 4



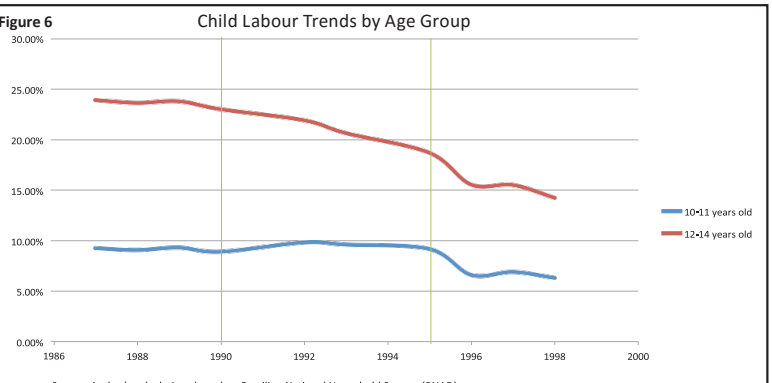
Source: Author's calculations based on Brazilian National Household Survey (PNAD)

Figure 5



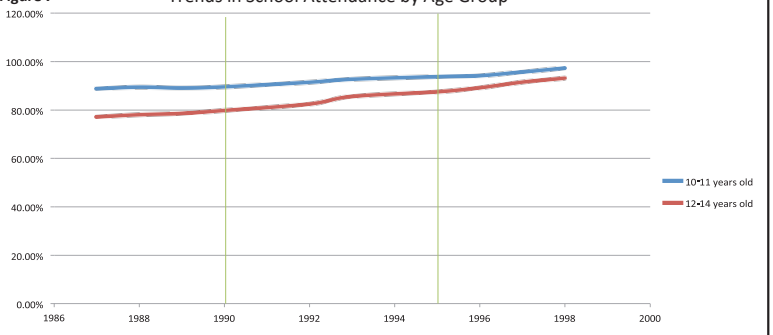
Source: Author's calculations based on Brazilian National Household Survey (PNAD)

Figure 6



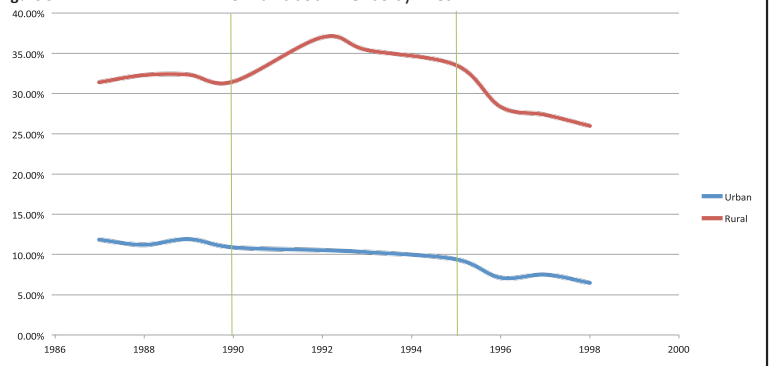
Source: Author's calculations based on Brazilian National Household Survey (PNAD)

Figure 7 Trends in School Attendance by Age Group



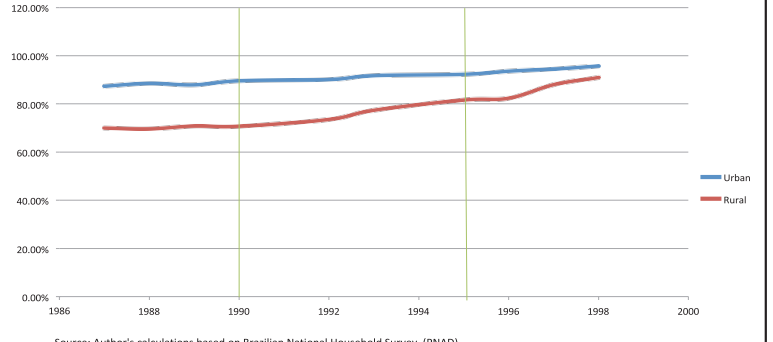
Source: Author's calculations based on Brazilian National Household Survey (PNAD)

Figure 8 Child Labour Trends by Area



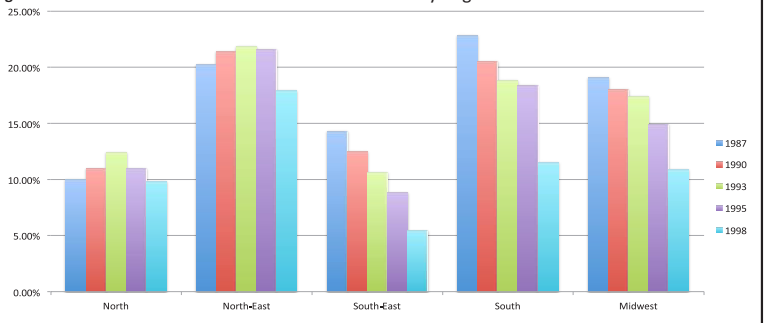
Source: Author's calculations based on Brazilian National Household Survey (PNAD)

Figure 9 Trends in School Attendance by Area



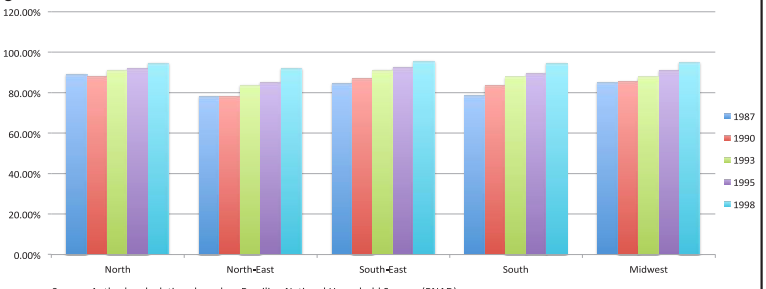
Source: Author's calculations based on Brazilian National Household Survey (PNAD)

Figure 10 Child Labour Trends by Region



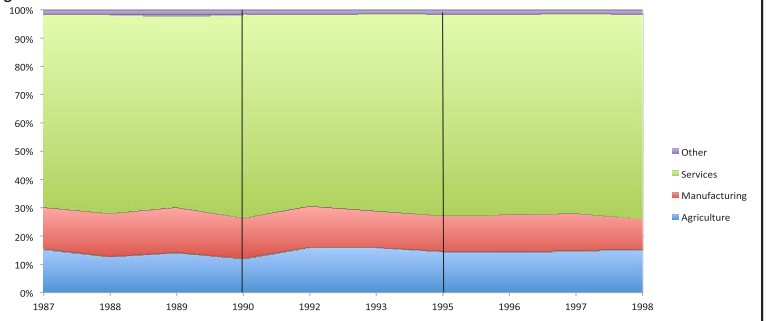
Source: Author's calculations based on Brazilian National Household Survey (PNAD)

Figure 11 Trends in School Attendance by Region



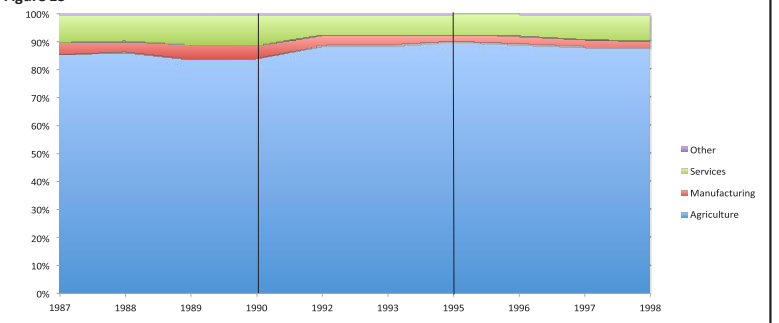
Source: Author's calculations based on Brazilian National Household Survey (PNAD)

Figure 12 Child Labour Trends by Sector - Urban Areas



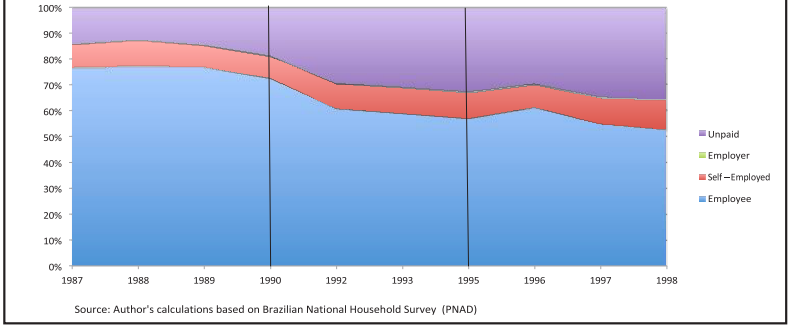
Source: Author's calculations based on Brazilian National Household Survey (PNAD)

Figure 13



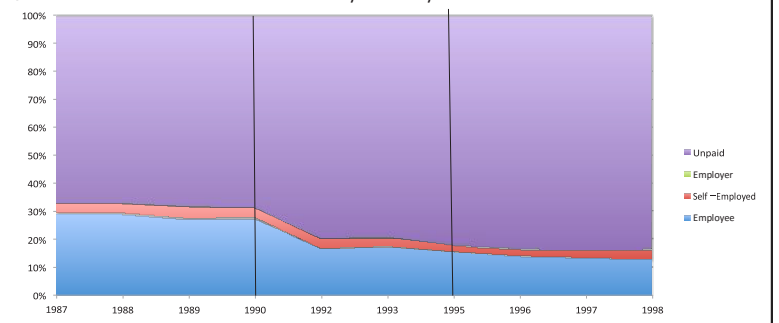
Source: Author's calculations based on Brazilian National Household Survey (PNAD)

Figure 14



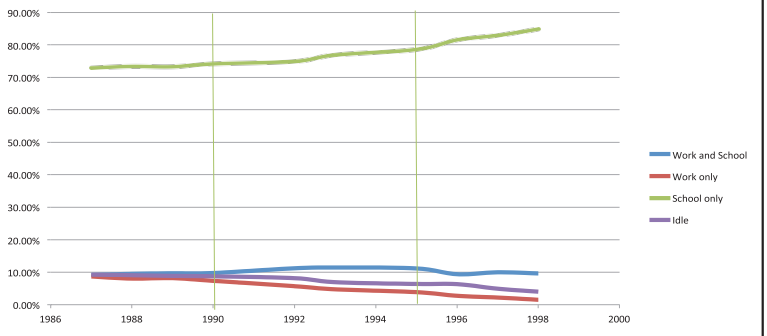
Source: Author's calculations based on Brazilian National Household Survey (PNAD)

Figure 15



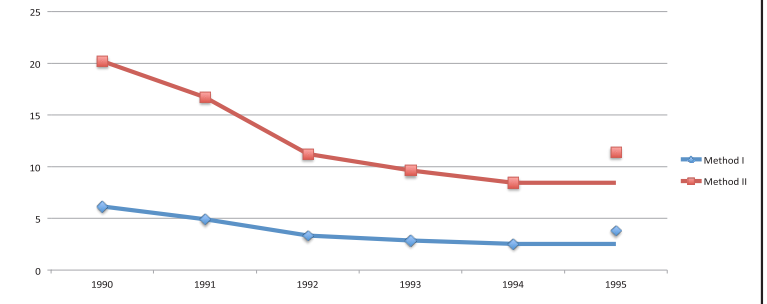
Source: Author's calculations based on Brazilian National Household Survey (PNAD)

Figure 16 Trends in School and Work



Source: Author's calculations based on Brazilian National Household Survey (PNAD)

Figure 17 Trends in the Tariff Measures



Source: Author's calculations based on Brazilian National Household Survey (PNAD) and Kume et al. (2003) as reported in Abreu (2004)

Tables

TABLE I
POOLED RESULTS: CHILD LABOUR, SCHOOL ATTENDANCE AND TARIFF PROTECTION

Specification 1-Lag 0						
Sample	All		Female		Male	
	[1]	[2]	[3]	[4]	[5]	[6]
Dependent	Work	School	Work	School	Work	School
ITE-NT	0.002	0.008***	0.001	0.009***	0.002	0.007**
	[0.004]	[0.003]	[0.004]	[0.003]	[0.004]	[0.003]
ITE-T	0.001	0.003***	0.001	0.003***	0.001	0.003***
	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]
Observations	150066	150066	74513	74513	75553	75553
Specification 1-Lag 1						
ITE-NT	-0.001	0.002	-0.003	0.009	0.001	-0.004
	[0.010]	[0.004]	[0.012]	[0.006]	[0.010]	[0.004]
ITE-T	-0.003	0.003**	-0.003	0.004**	-0.003	0.003*
	[0.002]	[0.001]	[0.002]	[0.002]	[0.002]	[0.002]
Observations	114195	114195	56528	56528	57667	57667
Specification 1-Lag 2						
ITE-NT	-0.002	0.003	-0.004	0.008*	-0.001	-0.002
	[0.008]	[0.003]	[0.009]	[0.004]	[0.008]	[0.003]
ITE-T	-0.002	0.003***	-0.002	0.003**	-0.003*	0.002*
	[0.001]	[0.001]	[0.002]	[0.001]	[0.001]	[0.001]
Observations	114195	114195	56528	56528	57667	57667

Notes:
All specifications include state and year fixed effects, controls for a child's gender, age and ethnicity, controls for the household head's gender, age, literacy status, sector of employment and level of education, and an urban indicator.
*Standard errors in brackets are clustered at state level. ***,**,* denote significance at the 1,5 and 10 percent level, respectively.*

TABLE 2
SECOND STAGE RESULTS OF IV ESTIMATION

Sample	All		Female		Male	
	[1]	[2]	[3]	[4]	[5]	[6]
Dependent	Work	School	Work	School	Work	School
ITE-NT	0.004	0.014***	0.004	0.015***	0.003	0.014***
	[0.004]	[0.003]	[0.005]	[0.004]	[0.003]	[0.004]
ITE-NT*R	-0.011***	0.012***	-0.006	0.011**	-0.015***	0.012***
	[0.004]	[0.003]	[0.004]	[0.005]	[0.005]	[0.003]
ITE-NT*U	0.002	0.014***	0.003	0.014***	0.001	0.014***
	[0.003]	[0.003]	[0.005]	[0.004]	[0.003]	[0.004]
IV	Yes	Yes	Yes	Yes	Yes	Yes
Observations	150066	150066	74513	74513	75553	75553
Specification 2 and 3-Lag 1						
ITE-NT	-0.016	0.020**	-0.015	0.023**	-0.018	0.017
	[0.012]	[0.010]	[0.014]	[0.011]	[0.013]	[0.011]
ITE-NT*R	-0.031	0.005	-0.022	0.014	-0.041	-0.003
	[0.028]	[0.013]	[0.028]	[0.014]	[0.031]	[0.016]
ITE-NT*U	-0.023	0.013	-0.018	0.019	-0.029*	0.007
	[0.014]	[0.008]	[0.016]	[0.012]	[0.015]	[0.008]
IV	Yes	Yes	Yes	Yes	Yes	Yes
Observations	114195	114195	56528	56528	57667	57667
Specification 2 and 3-Lag 2						
ITE-NT	-0.014	0.018**	-0.012	0.020**	-0.017*	0.015
	[0.010]	[0.008]	[0.011]	[0.009]	[0.010]	[0.009]
ITE-NT*R	-0.029	0.006	-0.022	0.013	-0.037	0.000
	[0.021]	[0.011]	[0.021]	[0.011]	[0.023]	[0.013]
ITE-NT*U	-0.022*	0.012*	-0.017	0.017*	-0.027**	0.008
	[0.011]	[0.007]	[0.013]	[0.009]	[0.012]	[0.006]
IV	Yes	Yes	Yes	Yes	Yes	Yes
Observations	114195	114195	56528	56528	57667	57667

Notes:
All specifications include state and year fixed effects, controls for a child's gender, age and ethnicity, controls for the household head's gender, age, literacy status, sector of employment and level of education, and an urban indicator.
*Standard errors in brackets are clustered at state level. ***,**,* denote significance at the 1,5 and 10 percent level, respectively.*

TABLE 3
RESULTS FOR MAIN SPECIFICATION

Specification 4-Lag 0						
Sample	All		Female		Male	
	[1]	[2]	[3]	[4]	[5]	[6]
Dependent	Work	School	Work	School	Work	School
ITE-NT*R	!0.043	0.013	!0.045	0.023	!0.041	0.006
	[0.044]	[0.019]	[0.053]	[0.019]	[0.039]	[0.020]
ITE-NT*U	!0.027	0.004	!0.032	0.012	!0.024	!0.002
	[0.018]	[0.008]	[0.023]	[0.010]	[0.016]	[0.007]
IV	Yes	Yes	Yes	Yes	Yes	Yes
Initial state (rural/ urban) conditions*time dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations	150066	150066	74513	74513	75553	75553
Specification 4-Lag 1						
ITE-NT*R	!0.032	0.037*	!0.025	0.055*	!0.041	0.020
	[0.067]	[0.022]	[0.073]	[0.030]	[0.067]	[0.021]
ITE-NT*U	!0.028	0.009	!0.030	0.020	!0.028	!0.001
	[0.022]	[0.011]	[0.027]	[0.015]	[0.022]	[0.010]
IV	Yes	Yes	Yes	Yes	Yes	Yes
Initial state (rural/ urban) conditions*time dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations	114195	114195	56528	56528	57667	57667
Specification 4-Lag 2						
ITE-NT*R	!0.036	0.027*	!0.030	0.042*	!0.044	0.013
	[0.047]	[0.016]	[0.053]	[0.022]	[0.045]	[0.015]
ITE-NT*U	!0.026	0.006	!0.028	0.015	!0.025	!0.002
	[0.018]	[0.009]	[0.022]	[0.012]	[0.018]	[0.008]
IV	Yes	Yes	Yes	Yes	Yes	Yes
Initial state (rural/ urban) conditions*time dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations	114195	114195	56528	56528	57667	57667

Notes:
All specifications include state and year fixed effects, controls for a child's gender, age and ethnicity, controls for the household head's gender, age, literacy status, sector of employment and level of education, and an urban indicator.
*Standard errors in brackets are clustered at state level. ***,**,* denote significance at the 1,5 and 10 percent level, respectively.*

TABLE 4
INTERACTIONS WITH HOUSEHOLD HEAD'S EDUCATION

Lag 0

Sample	All		Female		Male	
	[1]	[2]	[3]	[4]	[5]	[6]
Dependent	Work	School	Work	School	Work	School
No education*R*ITE	-0.039	0.010	!0.041	0.017	!0.037	0.004
	[0.044]	[0.018]	[0.053]	[0.019]	[0.041]	[0.018]
Attended primary*R*ITE	-0.043	0.015	!0.045	0.024	!0.041	0.007
	[0.044]	[0.018]	[0.053]	[0.019]	[0.041]	[0.018]
Attended middle*R*ITE	-0.048	0.021	!0.047	0.030	!0.049	0.014
	[0.046]	[0.019]	[0.055]	[0.021]	[0.042]	[0.019]
Attended secondary*R*ITE	-0.062	0.024	!0.059	0.032*	!0.063	0.017
	[0.046]	[0.018]	[0.055]	[0.019]	[0.042]	[0.019]
Attended higher*R*ITE	-0.062	0.020	!0.061	0.033*	!0.062	0.008
	[0.048]	[0.019]	[0.056]	[0.020]	[0.044]	[0.022]
No education*U*ITE	-0.031	0.007	!0.034	0.011	!0.030*	0.002
	[0.019]	[0.007]	[0.025]	[0.010]	[0.017]	[0.007]
Attended primary*U*ITE	-0.029	0.006	!0.033	0.013	!0.026	!0.001
	[0.019]	[0.008]	[0.023]	[0.010]	[0.017]	[0.007]
Attended middle*U*ITE	-0.029	0.007	!0.033	0.014	!0.026	0.000
	[0.019]	[0.007]	[0.024]	[0.010]	[0.017]	[0.007]
Attended secondary*U*ITE	-0.027	0.008	!0.032	0.017*	!0.024	0.001
	[0.019]	[0.008]	[0.024]	[0.010]	[0.017]	[0.007]
Attended higher*U*ITE	-0.028	0.008	!0.034	0.017*	!0.022	0.000
	[0.018]	[0.007]	[0.023]	[0.010]	[0.016]	[0.007]
IV	Yes	Yes	Yes	Yes	Yes	Yes
Initial state (rural/urban) conditions*time dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations	150066	150066	74513	74513	75553	75553

Notes:
All specifications include state and year fixed effects, controls for a child's gender, age and ethnicity, controls for the household head's gender, age, literacy status, sector of employment and level of education, and an urban indicator.
*Standard errors in brackets are clustered at state level. ***,**,* denote significance at the 1,5 and 10 percent level, respectively.*

TABLE 5
INTERACTION WITH HOUSEHOLD HEAD'S EDUCATION

Lag 1

Sample	All		Female		Male	
	[1]	[2]	[3]	[4]	[5]	[6]
Dependent	Work	School	Work	School	Work	School
No education*R*ITE	-0.030	0.030	!0.024	0.048*	!0.040	0.013
	[0.067]	[0.021]	[0.072]	[0.029]	[0.068]	[0.021]
Attended primary*R*ITE	-0.028	0.041*	!0.022	0.060**	!0.038	0.023
	[0.067]	[0.021]	[0.073]	[0.030]	[0.066]	[0.021]
Attended middle*R*ITE	-0.035	0.052**	!0.027	0.071**	!0.047	0.035*
	[0.068]	[0.023]	[0.075]	[0.032]	[0.068]	[0.021]
Attended secondary*R*ITE	-0.055	0.054**	!0.050	0.076**	!0.061	0.033*
	[0.066]	[0.023]	[0.074]	[0.032]	[0.066]	[0.020]
Attended higher*R*ITE	-0.060	0.045*	!0.052	0.073**	!0.069	0.018
	[0.070]	[0.026]	[0.081]	[0.033]	[0.067]	[0.023]
No education*U*ITE	-0.034	0.006	!0.035	0.015	!0.035	!0.003
	[0.023]	[0.011]	[0.027]	[0.015]	[0.024]	[0.010]
Attended primary*U*ITE	-0.028	0.011	!0.029	0.022	!0.030	0.001
	[0.023]	[0.011]	[0.028]	[0.015]	[0.022]	[0.010]
Attended middle*U*ITE	-0.028	0.016	!0.030	0.026*	!0.029	0.007
	[0.022]	[0.011]	[0.028]	[0.015]	[0.022]	[0.010]
Attended secondary*U*ITE	-0.027	0.015	!0.030	0.027*	!0.025	0.004
	[0.022]	[0.012]	[0.027]	[0.016]	[0.022]	[0.011]
Attended higher*U*ITE	-0.027	0.014	!0.033	0.026*	!0.023	0.003
	[0.023]	[0.012]	[0.028]	[0.015]	[0.022]	[0.010]
IV	Yes	Yes	Yes	Yes	Yes	Yes
Initial state (rural/urban) conditions*-time dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations	114195	114195	56528	56528	57667	57667

Notes:
All specifications include state and year fixed effects, controls for a child's gender, age and ethnicity, controls for the household head's gender, age, literacy status, sector of employment and level of education, and an urban indicator.
*Standard errors in brackets are clustered at state level. ***,**,* denote significance at the 1,5 and 10 percent level, respectively.*

TABLE 6
INTERACTIONS WITH HOUSEHOLD HEAD'S EDUCATION

Lag 2

Sample	All		Female		Male	
	[1]	[2]	[3]	[4]	[5]	[6]
Dependent	Work	School	Work	School	Work	School
No education*R*ITE	-0.034	0.022	!0.029	0.037*	!0.043	0.008
	[0.047]	[0.015]	[0.052]	[0.022]	[0.046]	[0.014]
Attended primary*R*ITE	-0.033	0.030*	!0.027	0.046**	!0.041	0.015
	[0.047]	[0.016]	[0.053]	[0.022]	[0.045]	[0.014]
Attended middle*R*ITE	-0.039	0.039**	!0.031	0.054**	!0.048	0.025*
	[0.048]	[0.017]	[0.055]	[0.024]	[0.047]	[0.015]
Attended secondary*R*ITE	-0.054	0.040**	!0.049	0.058**	!0.059	0.023*
	[0.046]	[0.017]	[0.054]	[0.023]	[0.045]	[0.014]
Attended higher*R*ITE	-0.060	0.033*	!0.053	0.057**	!0.068	0.010
	[0.049]	[0.020]	[0.059]	[0.024]	[0.045]	[0.018]
No education*U*ITE	-0.031	0.004	!0.032	0.013	!0.031	!0.004
	[0.019]	[0.009]	[0.022]	[0.012]	[0.020]	[0.008]
Attended primary*U*ITE	-0.026	0.008	!0.027	0.017	!0.027	!0.001
	[0.019]	[0.009]	[0.023]	[0.012]	[0.019]	[0.008]
Attended middle*U*ITE	-0.026	0.011	!0.028	0.020	!0.026	0.003
	[0.019]	[0.009]	[0.023]	[0.012]	[0.018]	[0.008]
Attended secondary*U*ITE	-0.025	0.011	!0.028	0.021*	!0.023	0.001
	[0.018]	[0.009]	[0.022]	[0.012]	[0.018]	[0.009]
Attended higher*U*ITE	-0.025	0.010	!0.031	0.020	!0.022	0.000
	[0.019]	[0.009]	[0.023]	[0.012]	[0.018]	[0.008]
IV	Yes	Yes	Yes	Yes	Yes	Yes
Initial state (rural/urban) conditions*-time dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations	114195	114195	56528	56528	57667	57667

Notes:
All specifications include state and year fixed effects, controls for a child's gender, age and ethnicity, controls for the household head's gender, age, literacy status, sector of employment and level of education, and an urban indicator.
*Standard errors in brackets are clustered at state level. ***,**,* denote significance at the 1,5 and 10 percent level, respectively.*

TABLE 7
INTERACTIONS WITH HOUSEHOLD HEAD'S MAIN SECTOR OF EMPLOYMENT

Lag 0

Sample	All		Female		Male	
	[1]	[2]	[3]	[4]	[5]	[6]
Dependent	Work	School	Work	School	Work	School
Agriculture*R*ITE	-0.025	0.009	!0.034	0.017	!0.018	0.004
	[0.041]	[0.019]	[0.050]	[0.021]	[0.038]	[0.020]
Manufacturing*R*ITE	-0.040	0.013	!0.041	0.022	!0.039	0.007
	[0.041]	[0.018]	[0.051]	[0.019]	[0.037]	[0.019]
Services*R*ITE	-0.043	0.017	!0.046	0.026	!0.043	0.010
	[0.042]	[0.019]	[0.052]	[0.020]	[0.038]	[0.019]
Other*R*ITE	-0.043	0.008	!0.047	0.038	!0.042	!0.009
	[0.043]	[0.021]	[0.054]	[0.023]	[0.039]	[0.022]
Inactive*R*ITE	-0.035	0.007	!0.040	0.016	!0.032	0.000
	[0.041]	[0.019]	[0.050]	[0.020]	[0.038]	[0.019]
Agriculture*U*ITE	-0.040**	0.003	!0.037	0.010	!0.045***	!0.003
	[0.018]	[0.010]	[0.023]	[0.012]	[0.017]	[0.010]
Manufacturing*U*ITE	-0.028*	0.006	!0.033	0.014	!0.024*	!0.001
	[0.017]	[0.007]	[0.022]	[0.009]	[0.015]	[0.007]
Services*U*ITE	-0.027	0.004	!0.032	0.012	!0.024	!0.002
	[0.017]	[0.007]	[0.022]	[0.009]	[0.015]	[0.007]
Other*U*ITE	-0.021	-0.002	!0.024	0.006	!0.021	!0.009
	[0.017]	[0.008]	[0.023]	[0.009]	[0.016]	[0.009]
Inactive*U*ITE	-0.023	0.004	!0.027	0.010	!0.020	!0.002
	[0.017]	[0.008]	[0.023]	[0.010]	[0.015]	[0.008]
IV	Yes	Yes	Yes	Yes	Yes	Yes
Initial state (rural/urban) conditions*-time dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations	150066	150066	74513	74513	75553	75553

Notes:
All specifications include state and year fixed effects, controls for a child's gender, age and ethnicity, controls for the household head's gender, age, literacy status, sector of employment and level of education, and an urban indicator.
*Standard errors in brackets are clustered at state level. ***,**,* denote significance at the 1,5 and 10 percent level, respectively.*

TABLE 8
INTERACTIONS WITH HOUSEHOLD HEAD'S MAIN SECTOR OF EMPLOYMENT

Lag 1

Sample	All		Female		Male	
	[1]	[2]	[3]	[4]	[5]	[6]
Dependent	Work	School	Work	School	Work	School
Agriculture*R*ITE	-0.011	0.034	!0.011	0.052*	!0.016	0.018
	[0.065]	[0.022]	[0.071]	[0.029]	[0.066]	[0.023]
Manufacturing*R*ITE	-0.037	0.040*	-0.029	0.056*	-0.050	0.025
	[0.063]	[0.023]	[0.070]	[0.031]	[0.063]	[0.021]
Services*R*ITE	-0.040	0.043*	!0.031	0.062**	!0.054	0.027
	[0.065]	[0.023]	[0.073]	[0.031]	[0.063]	[0.022]
Other*R*ITE	-0.045	0.055**	!0.033	0.067*	!0.062	0.039*
	[0.074]	[0.027]	[0.081]	[0.039]	[0.074]	[0.022]
Inactive*R*ITE	-0.041	0.030	!0.033	0.048	!0.053	0.013
	[0.064]	[0.023]	[0.070]	[0.030]	[0.064]	[0.021]
Agriculture*U*ITE	-0.036	0.002	!0.032	0.015	!0.041*	!0.011
	[0.023]	[0.011]	[0.027]	[0.016]	[0.024]	[0.010]
Manufacturing*U*ITE	-0.032	0.010	!0.033	0.020	!0.033	0.002
	[0.021]	[0.012]	[0.025]	[0.015]	[0.020]	[0.011]
Services*U*ITE	-0.028	0.010	!0.030	0.021	!0.029	0.000
	[0.021]	[0.011]	[0.027]	[0.015]	[0.020]	[0.010]
Other*U*ITE	-0.021	0.014	!0.025	0.030*	!0.021	!0.001
	[0.022]	[0.012]	[0.027]	[0.015]	[0.023]	[0.011]
Inactive*U*ITE	-0.029	0.009	!0.031	0.017	!0.031	0.001
	[0.021]	[0.011]	[0.026]	[0.015]	[0.021]	[0.011]
IV	Yes	Yes	Yes	Yes	Yes	Yes
Initial state (rural/urban) conditions*-time dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations	114195	114195	56528	56528	57667	57667

Notes:
All specifications include state and year fixed effects, controls for a child's gender, age and ethnicity, controls for the household head's gender, age, literacy status, sector of employment and level of education, and an urban indicator.
*Standard errors in brackets are clustered at state level. ***,**,* denote significance at the 1,5 and 10 percent level, respectively.*

TABLE 9
INTERACTIONS WITH HOUSEHOLD HEAD'S MAIN SECTOR OF EMPLOYMENT

Lag 2						
Sample	All	Female	Male			
	[1]	[2]	[3]	[4]	[5]	[6]
Dependent	Work	School	Work	School	Work	School
Agriculture*R*ITE	-0.020	0.025	!0.019	0.039*	!0.025	0.012
	[0.046]	[0.016]	[0.052]	[0.022]	[0.046]	[0.015]
Manufacturing*R*ITE	-0.040	0.029*	!0.033	0.042*	!0.050	0.016
	[0.045]	[0.017]	[0.051]	[0.023]	[0.043]	[0.014]
Services*R*ITE	-0.043	0.032*	!0.034	0.047**	!0.054	0.018
	[0.045]	[0.017]	[0.053]	[0.023]	[0.043]	[0.015]
Other*R*ITE	-0.046	0.041*	!0.035	0.051*	!0.060	0.027
	[0.053]	[0.022]	[0.059]	[0.030]	[0.051]	[0.018]
Inactive*R*ITE	-0.043	0.021	!0.036	0.036	!0.053	0.007
	[0.045]	[0.016]	[0.051]	[0.022]	[0.043]	[0.015]
Agriculture*U*ITE	-0.033*	0.001	!0.030	0.012	!0.037*	!0.010
	[0.019]	[0.009]	[0.022]	[0.012]	[0.020]	[0.008]
Manufacturing*U*ITE	-0.029*	0.007	!0.031	0.015	!0.029*	!0.001
	[0.017]	[0.009]	[0.021]	[0.012]	[0.017]	[0.008]
Services*U*ITE	-0.026	0.007	!0.028	0.016	!0.026	!0.002
	[0.017]	[0.009]	[0.022]	[0.012]	[0.017]	[0.008]
Other*U*ITE	-0.020	0.010	!0.024	0.023*	!0.019	!0.002
	[0.018]	[0.010]	[0.022]	[0.012]	[0.019]	[0.009]
Inactive*U*ITE	-0.027	0.006	!0.028	0.013	!0.027	!0.001
	[0.018]	[0.009]	[0.021]	[0.012]	[0.018]	[0.008]
IV	Yes	Yes	Yes	Yes	Yes	Yes
Initial state (rural/urban) conditions*-time dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations	114195	114195	56528	56528	57667	57667

Notes:
All specifications include state and year fixed effects, controls for a child's gender, age and ethnicity, controls for the household head's gender, age, literacy status, sector of employment and level of education, and an urban indicator.
*Standard errors in brackets are clustered at state level. ***,**,* denote significance at the 1,5 and 10 percent level, respectively.*

TABLE 10
CHILDREN IN 'SKILLED' HOUSEHOLDS AND TARIFF PROTECTION

Specification 4-Lag 0				
Sample	Female		Male	
	[1]	[2]	[3]	[4]
Dependent	Work	School	Work	School
ITE-NT*R	!0.001	0.012	!0.006	0.008
	[0.016]	[0.019]	[0.017]	[0.013]
ITE-NT*U	!0.001	0.004	!0.015	0.004
	[0.014]	[0.013]	[0.015]	[0.009]
IV	Yes	Yes	Yes	Yes
Initial state (rural/urban) conditions*time dummies	Yes	Yes	Yes	Yes
Observations	17157	17157	16685	16685
Specification 4-Lag 1				
ITE-NT*R	!0.024	0.070***	!0.028	0.040***
	[0.023]	[0.024]	[0.031]	[0.013]
ITE-NT*U	!0.028	0.038*	!0.010	0.028***
	[0.019]	[0.021]	[0.023]	[0.011]
IV	Yes	Yes	Yes	Yes
Initial state (rural/urban) conditions*time dummies	Yes	Yes	Yes	Yes
Observations	13385	13385	13208	13208
Specification 4-Lag 2				
ITE-NT*R	!0.031	0.059***	!0.013	0.033**
	[0.021]	[0.022]	[0.027]	[0.014]
ITE-NT*U	!0.035*	0.035*	!0.011	0.025**
	[0.019]	[0.021]	[0.024]	[0.012]
IV	Yes	Yes	Yes	Yes
Initial state (rural/urban) conditions*time dummies	Yes	Yes	Yes	Yes
Observations	13385	13385	13208	13208

Notes:
All specifications include state and year fixed effects, controls for a child's gender, age and ethnicity, controls for the household head's gender, age, literacy status, sector of employment and level of education, and an urban indicator.
*Standard errors in brackets are clustered at state level. ***,**,* denote significance at the 1,5 and 10 percent level, respectively.*

TABLE 11
CHILDREN IN 'UNSKILLED' HOUSEHOLDS AND TARIFF PROTECTION

Specification 4-Lag 0				
Sample	Female		Male	
	[1]	[2]	[3]	[4]
Dependent	Work	School	Work	School
ITE-NT*R	0.005	!0.014	!0.002	!0.011
	[0.016]	[0.011]	[0.010]	[0.012]
ITE-NT*U	!0.008	!0.005	0.014	!0.017
	[0.015]	[0.010]	[0.015]	[0.011]
IV	Yes	Yes	Yes	Yes
Initial state (rural/urban) conditions*time dummies	Yes	Yes	Yes	Yes
Observations	57356	57356	58868	58868
Specification 4-Lag 1				
ITE-NT*R	0.069	!0.023	0.081	!0.076
	[0.101]	[0.045]	[0.111]	[0.072]
ITE-NT*U	0.046	!0.009	0.100	!0.072
	[0.081]	[0.037]	[0.094]	[0.055]
IV	Yes	Yes	Yes	Yes
Initial state (rural/urban) conditions*time dummies	Yes	Yes	Yes	Yes
Observations	43143	43143	44459	44459
Specification 4-Lag 2				
ITE-NT*R	0.064	!0.010	0.075	!0.039
	[0.067]	[0.027]	[0.076]	[0.037]
ITE-NT*U	0.049	!0.002	0.093	!0.042
	[0.057]	[0.023]	[0.069]	[0.031]
IV	Yes	Yes	Yes	Yes
Initial state (rural/urban) conditions*time dummies	Yes	Yes	Yes	Yes
Observations	43143	43143	44459	44459

Notes:
All specifications include state and year fixed effects, controls for a child's gender, age and ethnicity, controls for the household head's gender, age, literacy status, sector of employment and level of education, and an urban indicator.
*Standard errors in brackets are clustered at state level. ***,**,* denote significance at the 1,5 and 10 percent level, respectively.*

TABLE 12
HOURS WORKED OF CHILDREN AND TARIFF PROTECTION

Lag 0			
Sample	All	Female	Male
	[1]	[2]	[3]
Dependent	Hours worked	Hours worked	Hours worked
ITE-NT*R	-1.904	-2.001	-1.765*
	[1.293]	[1.749]	[1.038]
ITE-NT*U	-1.190**	-1.373*	-1.038**
	[0.577]	[0.754]	[0.500]
IV	Yes	Yes	Yes
Initial state (rural/urban) conditions*time dummies	Yes	Yes	Yes
Observations	150061	74513	75548
Lag 1			
ITE-NT*R	-1.576	-1.357	-1.901
	[2.222]	[2.480]	[2.198]
ITE-NT*U	-1.231	-1.313	-1.216
	[0.799]	[0.972]	[0.777]
IV	Yes	Yes	Yes
Initial state (rural/urban) conditions*time dummies	Yes	Yes	Yes
Observations	114190	56528	57662
Lag 2			
ITE-NT*R	-1.698	-1.462	-1.984
	[1.692]	[1.940]	[1.614]
ITE-NT*U	-1.195*	-1.247	-1.184*
	[0.712]	[0.847]	[0.691]
IV	Yes	Yes	Yes
Initial state (rural/urban) conditions*time dummies	Yes	Yes	Yes
Observations	114190	56528	57662

Notes:
All specifications include state and year fixed effects, controls for a child's gender, age and ethnicity, controls for the household head's gender, age, literacy status, sector of employment and
level of education, and an urban indicator. Standard errors in brackets are clustered at state level.
****,**,* denote significance at the 1,5 and 10 percent level, respectively.*

TABLE 13
WORK MODALITY OF CHILDREN AND TARIFF PROTECTION

Lag 0									
Sample	All	Female	Male	All	Female	Male	All	Female	Male
Dependent	Employee	Employee	Employee	Self-employed	Self-employed	Self-employed	Unpaid	Unpaid	Unpaid
ITE-NT*R	0.010	-0.001	0.021	0.004	0.005	0.004	-0.057	-0.049	-0.066
	[0.007]	[0.008]	[0.013]	[0.004]	[0.005]	[0.005]	[0.047]	[0.048]	[0.051]
ITE-NT*U	-0.006	-0.009***	-0.004	0.002	0.004	0.001	-0.023	-0.027	-0.021
	[0.004]	[0.003]	[0.007]	[0.002]	[0.003]	[0.002]	[0.020]	[0.021]	[0.021]
IV	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Initial state (rural/ urban) conditions*-time dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	150066	74513	75553	150066	74513	75553	150066	74513	75553
Lag 1									
ITE-NT*R	!0.004	0.002	!0.009	0.003	0.010*	!0.004	!0.031	!0.037	!0.030
	[0.010]	[0.006]	[0.018]	[0.005]	[0.006]	[0.006]	[0.069]	[0.072]	[0.071]
ITE-NT*U	!0.012**	!0.009**	!0.014*	0.002	0.006	!0.002	!0.019	!0.028	!0.013
	[0.005]	[0.004]	[0.008]	[0.003]	[0.005]	[0.003]	[0.023]	[0.025]	[0.025]
IV	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Initial state (rural/ urban) conditions*-time dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	114195	56528	57667	114195	56528	57667	114195	56528	57667
Lag 2									
ITE-NT*R	!0.006	0.000	!0.012	0.004	0.010**	!0.002	!0.033	!0.040	!0.030
	[0.008]	[0.005]	[0.013]	[0.003]	[0.005]	[0.004]	[0.048]	[0.051]	[0.049]
ITE-NT*U	!0.011***	!0.008**	!0.014**	0.002	0.006	!0.001	!0.017	!0.026	!0.011
	[0.004]	[0.003]	[0.006]	[0.002]	[0.004]	[0.002]	[0.019]	[0.021]	[0.020]
IV	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Initial state (rural/ urban) conditions*-time dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	114195	56528	57667	114195	56528	57667	114195	56528	57667

Notes:
All specifications include state and year fixed effects, controls for a child's gender, age and ethnicity, controls for the household head's gender, age, literacy status, sector of employment and level of education, and an urban indicator.
*Standard errors in brackets are clustered at state level. ***, **, * denote significance at the 1, 5 and 10 percent level, respectively.*

TABLE 14
WORK SECTOR OF CHILDREN AND TARIFF PROTECTION

Sample	All	Female	Male	All	Female	Male	All	Female	Male	All	Female	Male
Dependent	Agriculture	Agriculture	Agriculture	Manufacturing	Manufacturing	Manufacturing	Services	Services	Services	Other	Other	Other
Lag 0												
ITE-NT*R	!0.051	!0.048	!0.052	0.005**	0.003	0.007**	0.001	0.000	0.001	0.002**	0.000	0.003*
	[0.041]	[0.046]	[0.041]	[0.002]	[0.003]	[0.004]	[0.007]	[0.008]	[0.008]	[0.001]	[0.000]	[0.002]
ITE-NT*U	!0.020	!0.024	!0.016	0.000	0.000	0.001	!0.009***	!0.008**	!0.010***	0.000	0.000	0.001*
	[0.017]	[0.021]	[0.017]	[0.001]	[0.001]	[0.002]	[0.003]	[0.004]	[0.003]	[0.000]	[0.000]	[0.001]
IV	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Initial state (rural/ urban) conditions*-time dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	150066	74513	75553	150066	74513	75553	150066	74513	75553	150066	74513	75553
Lag 1												
ITE-NT*R	!0.043	!0.040	!0.050	0.005	0.002	0.008	0.006	0.013	!0.002	0.001	0.000	0.003*
	[0.067]	[0.064]	[0.076]	[0.005]	[0.006]	[0.009]	[0.007]	[0.011]	[0.008]	[0.001]	[0.000]	[0.002]
ITE-NT*U	!0.019	!0.025	!0.016	!0.002	!0.001	!0.003	!0.008*	!0.005	!0.011*	0.001*	0.000	0.001*
	[0.022]	[0.025]	[0.023]	[0.002]	[0.001]	[0.003]	[0.005]	[0.005]	[0.006]	[0.000]	[0.000]	[0.001]
IV	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Initial state (rural/ urban) conditions*-time dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	114195	56528	57667	114195	56528	57667	114195	56528	57667	114195	56528	57667
Lag 2												
ITE-NT*R	!0.043	!0.041	!0.048	0.003	0.002	0.005	0.003	0.010	!0.004	0.001*	0.000	0.002**
	[0.045]	[0.046]	[0.050]	[0.004]	[0.005]	[0.006]	[0.005]	[0.008]	[0.006]	[0.001]	[0.000]	[0.001]
ITE-NT*U	!0.017	!0.023	!0.013	!0.002	!0.001	!0.003	!0.007**	!0.005	!0.010**	0.000*	0.000	0.001**
	[0.018]	[0.020]	[0.018]	[0.002]	[0.001]	[0.002]	[0.004]	[0.004]	[0.005]	[0.000]	[0.000]	[0.001]
IV	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Initial state (rural/ urban) conditions*-time dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	114195	56528	57667	114195	56528	57667	114195	56528	57667	114195	56528	57667

Notes:
All specifications include state and year fixed effects, controls for a child's gender, age and ethnicity, controls for the household head's gender, age, literacy status, sector of employment and level of education, and an urban indicator.
*Standard errors in brackets are clustered at state level. ***,**,* denote significance at the 1,5 and 10 percent level, respectively.*

TABLE 15
COMBINATIONS OF WORK & SCHOOL AND TARIFF PROTECTION

Lag 0												
Sample	All	Female	Male	All	Female	Male	All	Female	Male	All	Female	Male
Dependent	Work&School	Work&School	Work&School	Work only	Work only	Work only	School only	School only	School only	Idle	Idle	Idle
ITE-NT*R	!0.021	!0.017	!0.025	!0.022**	!0.028*	!0.016	0.034	0.040	0.031	0.009	0.006	0.010
	[0.043]	[0.040]	[0.049]	[0.010]	[0.015]	[0.018]	[0.030]	[0.029]	[0.034]	[0.015]	[0.028]	[0.009]
ITE-NT*U	!0.018	!0.016	!0.021	!0.009*	!0.016**	!0.003	0.023*	0.028**	0.019	0.005	0.004	0.005
	[0.016]	[0.017]	[0.018]	[0.005]	[0.008]	[0.006]	[0.013]	[0.014]	[0.014]	[0.006]	[0.012]	[0.004]
IV	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Initial state (rural/ urban) conditions*-time dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	150066	74513	75553	150066	74513	75553	150066	74513	75553	150066	74513	75553
Lag 1												
ITE-NT*R	!0.010	!0.002	!0.020	!0.022	!0.024	!0.021	0.046	0.057	0.040	!0.015	!0.032	0.002
	[0.057]	[0.060]	[0.058]	[0.019]	[0.018]	[0.025]	[0.056]	[0.052]	[0.064]	[0.016]	[0.033]	[0.016]
ITE-NT*U	!0.019	!0.017	!0.023	!0.009	!0.014	!0.006	0.028	0.037*	0.022	0.000	!0.006	0.007
	[0.019]	[0.021]	[0.021]	[0.007]	[0.008]	[0.008]	[0.019]	[0.019]	[0.021]	[0.008]	[0.015]	[0.007]
IV	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Initial state (rural/ urban) conditions*-time dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	114195	56528	57667	114195	56528	57667	114195	56528	57667	114195	56528	57667
Lag 2												
ITE-NT*R	!0.016	!0.010	!0.024	!0.019	!0.020	!0.019	0.043	0.052	0.037	!0.007	!0.022	0.007
	[0.041]	[0.043]	[0.042]	[0.012]	[0.013]	[0.015]	[0.038]	[0.036]	[0.044]	[0.012]	[0.025]	[0.010]
ITE-NT*U	!0.018	!0.016	!0.021	!0.008	!0.012*	!0.005	0.024	0.032**	0.018	0.002	!0.004	0.007
	[0.016]	[0.017]	[0.017]	[0.005]	[0.007]	[0.006]	[0.016]	[0.016]	[0.017]	[0.006]	[0.012]	[0.005]
IV	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Initial state (rural/ urban) conditions*-time dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	114195	56528	57667	114195	56528	57667	114195	56528	57667	114195	56528	57667

Notes:
All specifications include state and year fixed effects, controls for a child's gender, age and ethnicity, controls for the household head's gender, age, literacy status, sector of employment and level of education, and an urban indicator.
*Standard errors in brackets are clustered at state level. ***,**,* denote significance at the 1,5 and 10 percent level, respectively.*

WEB APPENDIX

TABLE 1
POOLED RESULTS: CHILD LABOUR, SCHOOL ATTENDANCE AND TARIFF PROTECTION

Model 1- Lag 0: Full Version

Sample	All				Female				Male			
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]
Dependent	Work	School	Work	School	Work	School	Work	School	Work	School	Work	School
ITE-NT	0.002	0.008***			0.001	0.009***			0.002	0.007**		
	[0.004]	[0.003]			[0.004]	[0.003]			[0.004]	[0.003]		
ITE-T			0.001	0.003***			0.001	0.003***			0.001	0.003***
			[0.001]	[0.001]			[0.001]	[0.001]			[0.001]	[0.001]
Urban	-0.113***	0.081***	-0.122***	0.041***	-0.065***	0.087***	-0.074***	0.045***	-0.156***	0.074***	-0.165***	0.036***
	[0.017]	[0.009]	[0.011]	[0.010]	[0.018]	[0.011]	[0.017]	[0.012]	[0.018]	[0.009]	[0.012]	[0.010]
Female	-0.107***	0.016***	-0.107***	0.016***								
	[0.010]	[0.005]	[0.010]	[0.005]								
Age	0.047***	-0.033***	0.047***	-0.033***	0.035***	-0.034***	0.035***	-0.034***	0.059***	-0.032***	0.059***	-0.032***
	[0.002]	[0.003]	[0.002]	[0.003]	[0.002]	[0.003]	[0.002]	[0.003]	[0.003]	[0.003]	[0.003]	[0.003]
White	-0.003	0.024***	-0.003	0.024***	-0.007**	0.023***	-0.007**	0.023***	0.001	0.025***	0.001	0.025***
	[0.004]	[0.004]	[0.004]	[0.004]	[0.004]	[0.004]	[0.004]	[0.004]	[0.005]	[0.005]	[0.005]	[0.005]
Head's gender: female	0.017***	-0.023***	0.017***	-0.023***	0.017***	-0.014***	0.017***	-0.014***	0.016***	-0.033***	0.016***	-0.033***
	[0.004]	[0.002]	[0.004]	[0.002]	[0.005]	[0.003]	[0.005]	[0.003]	[0.004]	[0.003]	[0.004]	[0.003]
Head's age	-0.001***	0.001***	-0.001***	0.001***	-0.001***	0.002***	-0.001***	0.002***	-0.001***	0.001***	-0.001***	0.001***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Head is literate	-0.023***	0.064***	-0.023***	0.064***	-0.013**	0.051***	-0.013**	0.051***	-0.033***	0.077***	-0.033***	0.077***
	[0.005]	[0.004]	[0.005]	[0.004]	[0.005]	[0.005]	[0.005]	[0.005]	[0.008]	[0.005]	[0.008]	[0.005]
Head's education: attended primary	-0.017***	0.039***	-0.018***	0.039***	-0.013**	0.032***	-0.013**	0.032***	-0.021**	0.044***	-0.021**	0.044***
	[0.006]	[0.004]	[0.006]	[0.004]	[0.006]	[0.004]	[0.006]	[0.004]	[0.008]	[0.004]	[0.008]	[0.004]
Head's education: attended middle	-0.051***	0.078***	-0.051***	0.077***	-0.034***	0.063***	-0.034***	0.063***	-0.068***	0.092***	-0.068***	0.092***
	[0.007]	[0.004]	[0.007]	[0.004]	[0.006]	[0.006]	[0.006]	[0.006]	[0.010]	[0.005]	[0.010]	[0.005]
Head's education: attended second	-0.073***	0.096***	-0.073***	0.096***	-0.038***	0.077***	-0.038***	0.077***	-0.112***	0.116***	-0.112***	0.115***
	[0.006]	[0.005]	[0.006]	[0.005]	[0.006]	[0.007]	[0.006]	[0.007]	[0.011]	[0.006]	[0.011]	[0.006]
Head's education: attended higher	-0.083***	0.098***	-0.083***	0.098***	-0.039***	0.080***	-0.039***	0.080***	-0.128***	0.115***	-0.128***	0.115***
	[0.008]	[0.006]	[0.008]	[0.006]	[0.009]	[0.008]	[0.009]	[0.008]	[0.013]	[0.007]	[0.013]	[0.007]
Head's sector of employment: Manufacturing	-0.139***	0.067***	-0.139***	0.067***	-0.082***	0.061***	-0.082***	0.061***	-0.195***	0.072***	-0.195***	0.072***
	[0.012]	[0.008]	[0.012]	[0.008]	[0.011]	[0.009]	[0.011]	[0.009]	[0.015]	[0.008]	[0.015]	[0.008]
Head's sector of employment: Services	-0.133***	0.068***	-0.133***	0.068***	-0.079***	0.063***	-0.079***	0.063***	-0.185***	0.072***	-0.185***	0.073***
	[0.011]	[0.007]	[0.011]	[0.007]	[0.009]	[0.007]	[0.009]	[0.007]	[0.015]	[0.007]	[0.015]	[0.007]
Head's sector of employment: Other	-0.142***	0.050***	-0.142***	0.050***	-0.093***	0.051***	-0.093***	0.051***	-0.187***	0.049***	-0.187***	0.049***
	[0.011]	[0.009]	[0.011]	[0.009]	[0.012]	[0.012]	[0.012]	[0.012]	[0.014]	[0.009]	[0.014]	[0.009]
Head is inactive	-0.156***	0.046***	-0.156***	0.046***	-0.090***	0.040***	-0.090***	0.040***	-0.219***	0.051***	-0.219***	0.051***
	[0.010]	[0.008]	[0.010]	[0.008]	[0.010]	[0.008]	[0.010]	[0.008]	[0.013]	[0.008]	[0.013]	[0.008]
time_1992	0.013	0.032***	0.018*	0.044***	0.012	0.035***	0.019	0.046***	0.013	0.030***	0.016	0.042***
	[0.009]	[0.007]	[0.009]	[0.007]	[0.010]	[0.007]	[0.012]	[0.009]	[0.012]	[0.008]	[0.010]	[0.009]
time_1993	0.007	0.054***	0.013	0.067***	0.009	0.056***	0.017	0.069***	0.004	0.052***	0.009	0.066***
	[0.010]	[0.007]	[0.010]	[0.008]	[0.012]	[0.008]	[0.014]	[0.010]	[0.011]	[0.010]	[0.010]	[0.011]
time_1995	-0.004	0.062***	0.001	0.076***	0.004	0.064***	0.011	0.078***	-0.013	0.059***	-0.009	0.074***
	[0.008]	[0.007]	[0.009]	[0.008]	[0.009]	[0.009]	[0.013]	[0.010]	[0.011]	[0.008]	[0.010]	[0.010]
State fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.17	0.10	0.17	0.10	0.08	0.09	0.08	0.09	0.21	0.12	0.21	0.12
Observations	150066	150066	150066	150066	74513	74513	74513	74513	75553	75553	75553	75553

*Notes: Standard errors in brackets are clustered at state level. ***,**,* denote significance at the 1,5 and 10 percent level.*
For head's education, no education is the omitted category. For head's sector of employment, agriculture is the omitted category.

TABLE 2
FIRST STAGE RESULTS OF IV ESTIMATION

IV-Lag 0	ITE-NT	ITE-NT*Urban	ITE-NT*Rural	F-Statistic
ITE-T	0.240***			72.41
	[0.028]			
ITE-T*U		0.258***		68.93
		[0.031]		
ITE-T*R			0.647***	228.65
			[0.043]	
R^2	0.91	0.97	0.98	
Observations	150066	150066	150066	
IV-Lag 1	ITE-NT	ITE-NT*Urban	ITE-NT*Rural	F-Statistic
ITE-T	0.174***			20.12
	[0.039]			
ITE-T*U		0.266***		65.19
		[0.033]		
ITE-T*R			0.573***	126.39
			[0.051]	
R^2	0.94	0.98	0.98	
Observations	114195	114195	114195	
IV-Lag 2	ITE-NT	ITE-NT*Urban	ITE-NT*Rural	F-Statistic
ITE-T	0.165***			18.02
	[0.039]			
ITE-T*U		0.263***		63.80
		[0.033]		
ITE-T*R			0.579***	135.57
			[0.050]	
R^2	0.94	0.97	0.98	
Observations	114195	114195	114195	

Notes:
All specifications include state and year fixed effects, controls for a child's gender, age and ethnicity, controls for the household head's gender, age, literacy status, sector of employment and
level of education, and an urban indicator. Standard errors in brackets are clustered at state level.
****,**,* denote significance at the 1,5 and 10 percent level, respectively.*

TABLE 3
RESULTS FOR MAIN SPECIFICATION

Specification 4-Lag 0 Full Version

Sample	All		Female		Male	
	[1]	[2]	[3]	[4]	[5]	[6]
Dependent	Work	School	Work	School	Work	School
ITE-T*R	!0.043	0.013	!0.045	0.023	!0.041	0.006
	[0.044]	[0.019]	[0.053]	[0.019]	[0.039]	[0.020]
ITE-T*U	!0.027	0.004	!0.032	0.012	!0.024	!0.002
	[0.018]	[0.008]	[0.023]	[0.010]	[0.016]	[0.007]
Agricultural share* 1992	0.019***	!0.001	0.019***	!0.002	0.019***	0.000
	[0.004]	[0.003]	[0.004]	[0.004]	[0.005]	[0.003]
Manufacturing share*1992	0.016***	0.000	0.015***	0.000	0.016***	0.000
	[0.005]	[0.003]	[0.005]	[0.004]	[0.006]	[0.003]
Other Industry share*1992	0.027**	0.003	0.027**	0.005	0.026*	0.002
	[0.013]	[0.005]	[0.012]	[0.007]	[0.015]	[0.005]
Commerce Share*1992	0.021***	!0.003	0.021***	!0.004	0.021**	!0.001
	[0.007]	[0.004]	[0.008]	[0.005]	[0.008]	[0.004]
Service share*1992	0.020***	!0.002	0.019***	!0.004	0.021***	0.000
	[0.005]	[0.003]	[0.005]	[0.004]	[0.006]	[0.003]
Other share*1992	0.027	!0.005	0.026	0.002	0.027	!0.011
	[0.016]	[0.008]	[0.017]	[0.009]	[0.019]	[0.008]
Agricultural share* 1993	0.018***	!0.003	0.018***	!0.006	0.018***	!0.001
	[0.004]	[0.003]	[0.004]	[0.004]	[0.006]	[0.003]
Manufacturing share*1993	0.014***	!0.003	0.013***	!0.004	0.014***	!0.002
	[0.004]	[0.003]	[0.005]	[0.005]	[0.005]	[0.003]
Other Industry share*1993	0.027**	!0.006	0.027***	!0.007	0.027*	!0.004
	[0.012]	[0.005]	[0.010]	[0.006]	[0.015]	[0.006]
Commerce share*1993	0.022***	!0.005	0.022***	!0.007	0.021**	!0.004
	[0.008]	[0.005]	[0.007]	[0.006]	[0.010]	[0.005]
Service share*1993	0.018***	!0.005	0.018***	!0.008*	0.018***	!0.001
	[0.005]	[0.003]	[0.004]	[0.005]	[0.006]	[0.003]
Other share*1993	0.032*	!0.009	0.026	!0.004	0.035*	!0.015**
	[0.017]	[0.007]	[0.018]	[0.009]	[0.019]	[0.006]
Agricultural share* 1995	0.023***	!0.005*	0.022***	!0.009**	0.025***	!0.002
	[0.005]	[0.003]	[0.006]	[0.004]	[0.006]	[0.003]

TABLE 3
RESULTS FOR MAIN SPECIFICATION

Manufacturing share*1995	0.018***	!0.004*	0.015***	!0.006*	0.021***	!0.003
	[0.004]	[0.002]	[0.005]	[0.003]	[0.004]	[0.003]
Other Industry share*1995	0.026**	!0.002	0.027**	!0.006	0.025	0.002
	[0.013]	[0.005]	[0.011]	[0.006]	[0.015]	[0.006]
Commerce share*1995	0.025***	!0.007*	0.023***	!0.010**	0.027***	!0.004
	[0.008]	[0.004]	[0.008]	[0.005]	[0.010]	[0.003]
Service share*1995	0.022***	!0.006**	0.020***	!0.010***	0.024***	!0.002
	[0.004]	[0.003]	[0.005]	[0.004]	[0.004]	[0.003]
Other share*1995	0.033	!0.013*	0.029	!0.011	0.036	!0.016**
	[0.021]	[0.008]	[0.022]	[0.010]	[0.022]	[0.008]
IV	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.17	0.10	0.08	0.09	0.21	0.12
Observations	150066	150066	74513	74513	75553	75553

Notes:
All specifications include state and year fixed effects, controls for a child's gender, age and ethnicity, controls for the household head's gender, age, literacy status, sector of employment and level of education, and an urban indicator.
1990 employment shares and the 1993 and 1995 construction share are the omitted categories.
*Standard errors in brackets are clustered at state level. ***,**,* denote significance at the 1,5 and 10 percent level, respectively.*

TABLE 4
RESULTS FOR MAIN SPECIFICATION

Specification 4-Lag 1 Full Version						
Sample	All		Female		Male	
	[1]	[2]	[3]	[4]	[5]	[6]
Dependent	Work	School	Work	School	Work	School
ITE-T*R	!0.032	0.037*	!0.025	0.055*	!0.041	0.020
	[0.067]	[0.022]	[0.073]	[0.030]	[0.067]	[0.021]
ITE-T*U	!0.028	0.009	!0.030	0.020	!0.028	!0.001
	[0.022]	[0.011]	[0.027]	[0.015]	[0.022]	[0.010]
Agricultural share* 1993	0.016***	!0.004	0.016***	!0.007	0.016**	!0.001
	[0.005]	[0.003]	[0.004]	[0.004]	[0.007]	[0.003]
Manufacturing share*1993	0.014***	!0.003	0.013***	!0.006	0.014**	!0.001
	[0.004]	[0.003]	[0.004]	[0.004]	[0.006]	[0.003]
Other Industry share*1993	0.026**	!0.010*	0.025**	!0.013*	0.026*	!0.008
	[0.011]	[0.006]	[0.010]	[0.007]	[0.014]	[0.007]
Commerce share*1993	0.019**	!0.005	0.018**	!0.007	0.019*	!0.004
	[0.008]	[0.005]	[0.008]	[0.005]	[0.010]	[0.004]
Service share*1993	0.016***	!0.005	0.016***	!0.009**	0.015**	!0.001
	[0.005]	[0.003]	[0.004]	[0.004]	[0.008]	[0.003]
Other share*1993	0.034*	!0.013*	0.023	!0.010	0.043**	!0.015**
	[0.018]	[0.007]	[0.018]	[0.009]	[0.020]	[0.008]
Agricultural share* 1995	0.018***	!0.004	0.017***	!0.008**	0.020***	!0.001
	[0.004]	[0.003]	[0.004]	[0.004]	[0.005]	[0.003]
Manufacturing share*1995	0.015***	!0.004*	0.013***	!0.006*	0.018***	!0.002
	[0.004]	[0.002]	[0.005]	[0.004]	[0.005]	[0.003]
Other Industry share*1995	0.023**	!0.006	0.023**	!0.011	0.023*	!0.001
	[0.010]	[0.006]	[0.010]	[0.007]	[0.013]	[0.007]
Commerce share*1995	0.022***	!0.007	0.018**	!0.010*	0.025**	!0.004
	[0.008]	[0.004]	[0.008]	[0.006]	[0.010]	[0.004]
Service share*1995	0.019***	!0.006**	0.017***	!0.010***	0.020***	!0.002
	[0.004]	[0.003]	[0.004]	[0.004]	[0.005]	[0.003]
Other share*1995	0.034*	!0.016**	0.025	!0.017*	0.042*	!0.016**
	[0.020]	[0.007]	[0.019]	[0.010]	[0.022]	[0.008]
IV	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.17	0.09	0.09	0.08	0.21	0.11
Observations	114195	114195	56528	56528	57667	57667

Notes:
All specifications include state and year fixed effects, controls for a child's gender, age and ethnicity, controls for the household head's gender, age, literacy status, sector of employment and level of education, and an urban indicator.
1992 employment shares and the 1993 and 1995 construction share are the omitted categories.
*Standard errors in brackets are clustered at state level. ***,**,* denote significance at the 1,5 and 10 percent level, respectively.*

TABLE 5
RESULTS FOR MAIN SPECIFICATION

Specification 4-Lag 2 Full Version

Sample	All		Female		Male	
	[1]	[2]	[3]	[4]	[5]	[6]
Dependent	Work	School	Work	School	Work	School
ITE-T*R	!0.036	0.027*	!0.030	0.042*	!0.044	0.013
	[0.047]	[0.016]	[0.053]	[0.022]	[0.045]	[0.015]
ITE-T*U	!0.026	0.006	!0.028	0.015	!0.025	!0.002
	[0.018]	[0.009]	[0.022]	[0.012]	[0.018]	[0.008]
Agricultural share* 1993	0.017***	!0.004	0.017***	!0.007	0.017**	!0.001
	[0.005]	[0.003]	[0.004]	[0.005]	[0.007]	[0.003]
Manufacturing share*1993	0.016***	!0.003	0.015***	!0.007	0.016**	!0.001
	[0.005]	[0.003]	[0.004]	[0.004]	[0.007]	[0.003]
Other Industry share*1993	0.027**	!0.009*	0.026***	!0.012*	0.027**	!0.007
	[0.011]	[0.006]	[0.010]	[0.006]	[0.014]	[0.007]
Commerce share*1993	0.019***	!0.004	0.019***	!0.006	0.020**	!0.003
	[0.007]	[0.005]	[0.007]	[0.005]	[0.009]	[0.004]
Service share*1993	0.017***	!0.005	0.017***	!0.009*	0.016**	0.000
	[0.005]	[0.004]	[0.004]	[0.005]	[0.007]	[0.003]
Other share*1993	0.034**	!0.010	0.023	!0.007	0.043***	!0.013**
	[0.014]	[0.006]	[0.015]	[0.008]	[0.016]	[0.007]
Agricultural share* 1995	0.018***	!0.003	0.017***	!0.006*	0.020***	!0.001
	[0.003]	[0.003]	[0.004]	[0.004]	[0.005]	[0.003]
Manufacturing share*1995	0.014***	!0.003	0.012**	!0.005	0.017***	!0.002
	[0.004]	[0.002]	[0.005]	[0.004]	[0.005]	[0.003]
Other Industry share*1995	0.022**	!0.005	0.023**	!0.008	0.022*	0.000
	[0.010]	[0.005]	[0.009]	[0.007]	[0.013]	[0.007]
Commerce share*1995	0.022***	!0.006	0.019***	!0.009*	0.025***	!0.004
	[0.007]	[0.004]	[0.007]	[0.005]	[0.009]	[0.004]
Service share*1995	0.018***	!0.005*	0.018***	!0.009***	0.020***	!0.001
	[0.003]	[0.003]	[0.004]	[0.004]	[0.005]	[0.003]
Other share*1995	0.035**	!0.014**	0.026	!0.015*	0.043**	!0.014**
	[0.017]	[0.007]	[0.016]	[0.009]	[0.019]	[0.007]
IV	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.17	0.09	0.09	0.08	0.21	0.11
Observations	114195	114195	56528	56528	57667	57667

Notes:
All specifications include state and year fixed effects, controls for a child's gender, age and ethnicity, controls for the household head's gender, age, literacy status, sector of employment and level of education, and an urban indicator.
1992 employment shares and the 1993 and 1995 construction share are the omitted categories.
*Standard errors in brackets are clustered at state level. ***,**,* denote significance at the 1,5 and 10 percent level, respectively.*

TABLE 6
RESULTS FOR MAIN SPECIFICATION USING EFFECTIVE RATES OF PROTECTION

Specification 4 using ERP-Lag 0						
Sample	All		Female		Male	
	[1]	[2]	[3]	[4]	[5]	[6]
Dependent	Work	School	Work	School	Work	School
ITE-T*R	!0.016	0.008	!0.016	0.010	!0.016	0.006
	[0.014]	[0.007]	[0.017]	[0.007]	[0.013]	[0.007]
ITE-T*U	!0.011	0.002	!0.014	0.005	!0.009	!0.001
	[0.007]	[0.003]	[0.009]	[0.004]	[0.006]	[0.003]
IV	Yes	Yes	Yes	Yes	Yes	Yes
Initial state (rural/urban) conditions*-time dummies	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.17	0.10	0.09	0.09	0.21	0.12
Observations	150066	150066	74513	74513	75553	75553
Specification 4 using ERP-Lag 1						
ITE-T*R	!0.020	0.017**	!0.018	0.025**	!0.023	0.010
	[0.026]	[0.009]	[0.030]	[0.013]	[0.024]	[0.007]
ITE-T*U	!0.014	0.004	!0.017	0.010	!0.013	!0.002
	[0.010]	[0.005]	[0.013]	[0.007]	[0.010]	[0.004]
IV	Yes	Yes	Yes	Yes	Yes	Yes
Initial state (rural/urban) conditions*-time dummies	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.17	0.09	0.09	0.08	0.21	0.11
Observations	114195	114195	56528	56528	57667	57667
Specification 4 using ERP-Lag 2						
ITE-T*R	!0.013	0.011*	!0.011	0.016*	!0.016	0.006
	[0.016]	[0.006]	[0.018]	[0.009]	[0.015]	[0.004]
ITE-T*U	!0.010	0.002	!0.012	0.006	!0.009	!0.002
	[0.008]	[0.004]	[0.010]	[0.005]	[0.007]	[0.003]
IV	Yes	Yes	Yes	Yes	Yes	Yes

TABLE 6
RESULTS FOR MAIN SPECIFICATION USING EFFECTIVE RATES OF PROTECTION

Initial state (rural/urban) conditions*-time dummies	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.17	0.09	0.09	0.08	0.21	0.11
Observations	114195	114195	56528	56528	57667	57667

Notes:
All specifications include state and year fixed effects, controls for a child's gender, age and ethnicity, controls for the household head's gender, age, literacy status, sector of employment and level of education, and an urban indicator.
*Standard errors in brackets are clustered at state level. ***,**,* denote significance at the 1,5 and 10 percent level, respectively.*

TABLE 7
RESULTS FOR MAIN SPECIFICATION WITH OUTLIERS DROPPED

Specification 4 w\o outliers -Lag 0						
Sample	All		Female		Male	
	[1]	[2]	[3]	[4]	[5]	[6]
Dependent	Work	School	Work	School	Work	School
ITE-T*R	!0.041	0.011	!0.046	0.022	!0.036	0.003
	[0.042]	[0.019]	[0.052]	[0.019]	[0.037]	[0.019]
ITE-T*U	!0.026	0.003	!0.032	0.010	!0.020	!0.004
	[0.018]	[0.007]	[0.023]	[0.009]	[0.015]	[0.007]
IV	Yes	Yes	Yes	Yes	Yes	Yes
Initial state (rural/urban) conditions*-time dummies	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.17	0.10	0.08	0.09	0.21	0.12
Observations	143361	143361	71116	71116	72245	72245
Specification 4 w\o outliers -Lag 1						
ITE-T*R	!0.030	0.031	!0.025	0.047*	!0.040	0.016
	[0.065]	[0.021]	[0.071]	[0.028]	[0.065]	[0.021]
ITE-T*U	!0.027	0.007	!0.031	0.017	!0.026	!0.003
	[0.021]	[0.011]	[0.026]	[0.014]	[0.021]	[0.010]
IV	Yes	Yes	Yes	Yes	Yes	Yes
Initial state (rural/urban) conditions*-time dummies	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.17	0.10	0.09	0.08	0.21	0.11
Observations	109357	109357	54069	54069	55288	55288
Specification 4 w\o outliers -Lag 2						
ITE-T*R	!0.034	0.022	!0.029	0.036*	!0.042	0.010
	[0.046]	[0.016]	[0.052]	[0.021]	[0.045]	[0.015]
ITE-T*U	!0.025	0.004	!0.028	0.013	!0.024	!0.004
	[0.018]	[0.009]	[0.021]	[0.011]	[0.018]	[0.008]
IV	Yes	Yes	Yes	Yes	Yes	Yes

TABLE 7
RESULTS FOR MAIN SPECIFICATION WITH OUTLIERS DROPPED

Initial state (rural/urban) conditions*-time dummies	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.17	0.1	0.09	0.08	0.21	0.11
Observations	109357	109357	54069	54069	55288	55288

Notes:
All specifications include state and year fixed effects, controls for a child's gender, age and ethnicity, controls for the household head's gender, age, literacy status, sector of employment and level of education, and an urban indicator.
*Standard errors in brackets are clustered at state level. ***,**,* denote significance at the 1,5 and 10 percent level, respectively.*

Authors

RIZA IRHAMNI

Riza is currently in her fourth year at the University of British Columbia pursuing a major in International Relations. She finished her degree requirements in December 2015 and is set for graduation in May 2016. She is originally from Jakarta, Indonesia, but moved to Seattle, United States in 2010. She participated in the International Service Learning program in the summer of 2015 and went to Uganda as an economics intern for Tekera Resource Centre, a non-profit organization. She conducted research on agriculture, income generating activities and market analysis. Her main interests lay mostly in international public health, asset- based community development, and the integration of economic principles in public health. In the future, she plans to enroll in a Master's degree program in Global Health or International Economic Development, followed by a career in public health education or project monitoring and evaluation.

JAMIE KOERNER

Born in Germany, Jamie Koerner moved to Canada in late 2011. The following year he enrolled at UBC, where his keen interest in development and trade motivated his specialization in Honours Economics. During his three years of undergraduate studies, Jamie became increasingly interested in the intersection of environmental issues and economic development. Currently pursuing an M.A. in Economics at the VSE, he plans to enroll in a Master of Environmental Science this coming September. Given his interdisciplinary interests, Jamie hopes to complete a PhD in Economics with a specialization in Environmental and Development Economics thereafter.

SHEREEN KOTB

Shereen is a Political Science student currently in her final year at the University of British Columbia. Her research interests include anything and everything related to Middle Eastern politics and comparative politics. In her free time, she enjoys reading dystopian novels, playing squash, and doing yoga. This year, she served as the Co-chair of the first Undergraduate Moot Court Competition in B.C and an editor for the Journal of Political Studies (JPS). Her post-graduate plans include pursuing a graduate degree in International Affairs, most likely in Paris. Upon graduating from the Master's program, she hopes to work for international organizations, such as the UN, or for large research institutions, such as Brookings Institute, Carnegie Endowment for International Peace or the Middle East Institute. She is specifically interested in conflict management and resolution, democratization, nuclear arms control, authoritarianism and civil-military relations. Ultimately, she hopes to return to the Middle East and shape public or foreign policy in the region.

DAWSON MCLEAN

Dawson McLean is originally from Port Moody, BC, and currently in his fourth year of the undergraduate majors program at the Vancouver School of Economics. He plans to pursue further education and research opportunities in environmental economics and econometrics. This past summer and fall he had the privilege of working as a research assistant with Dr. Rashid Sumaila and the Fisheries Economics Research Unit at the Institute of Oceans and Fisheries. He is now preparing to begin graduate studies with the hope of eventually being involved in a career involving economic research and analysis.

ROSHAK MOMTAHEN

Roshak Momtahen is in his fifth and final year at the University of British Columbia, graduating with a double major in Economics and Political Science. He was born in Tehran and raised in Vancouver's North Shore. Roshak has always been fascinated by the dynamic interplay between political conditions and economic outcomes. His interests are in economic history, development, globalization, and political economy. In particular, he is interested in industrial policy in developing countries. As an active participant in the student movement, he has served multiple terms as an elected representative on the governing council of UBC's student union. During that time, he had the opportunity to serve as a Chairperson of the committee responsible for lobbying and as a founding member of the AMS Sustainability Fund. Roshak will begin his Masters studies next September at the Barcelona Graduate School of Economics. He hopes to eventually continue into a PhD program in Economics.

JEFFREY PAI

Born and raised in Vancouver, BC, Jeffrey Pai is currently in his fourth year of study at the University of British Columbia pursuing a major in Economics with a minor in Commerce. His interests in economics involve dynamics surrounding the relationship between microeconomic behaviour and macroeconomic policy. Graduating in November of 2016, Jeffrey plans to attain a professional degree in the areas of international macroeconomics and finance.

DONGXIAO ZHANG

Dongxiao is currently in his fourth year at the University of British Columbia, pursuing a double major in Economics and Mathematics. His most recent interests include issues related to environmental and international economics. He plans to start his PhD at UBC in September 2016.

IONA Journal Team

EDITOR IN CHIEF, FOUNDER

TERRALYNN FORSYTH

Bachelor of Arts
Double Major Economics and International Relations

Terralynn is currently in her fifth and final year, graduating in May 2016. She is interested in a vast range of topical issues to do with political economy and digital disruption. She hopes to utilize her passion for economic thought, interests in technology, innovation and entrepreneurship, and her editorial experience with the journal for a career in research and analysis. In the meantime, she enjoys expanding her coin collection and personal library and looking for any excuse to cook and travel.

MANAGING EDITOR

LIZAVETA AKHVLEDZIANI

Bachelor of International Economics

Liza is currently in her second year in the Bachelor of International Economics program. She was born and raised in Belarus, but attended high school in North Wales, where she attained her IB diploma. Although she is equally interested in both micro and macro economics, international trade is what fascinates her. She is keenly interested in the business aspect of operations and is looking to go into investment banking and trade.

SENIOR EDITORS

DOUGLAS BRYAN

Bachelor of Arts
Economics Major and Commerce Minor

Doug is currently in his fourth year studying Economics with a minor in Commerce. He was born and raised in Birmingham, England, but made the move with his family to North Vancouver in 2008. As the son of a Health Economist, he has been exposed to an economic way of thinking for a long time. He was gripped by the economic problems of a "developing" country and envisions a potential career in development economics.

ADAM GOLD

Bachelor of Arts
International Relations Major and Chinese Language and Culture Minor

Adam is currently in his third year studying International Relations with a minor in Chinese Language and Culture. He was born in Berkeley and raised in Oakland, California. Adam pursues his passion of economics through a "divergent lens"—international relations—that aids as a compliment to his interests in development and international political economy. Adam is interested in pursuing international refugee and humanitarian law in the future.

SHEBLI KHOURY

Bachelor of Arts
Economics Major

Shebli is currently in his third year studying Economics. He was born and raised in Jordan for eighteen years. He received admission to UBC three years ago, but accepted an offer to attend Sciences Po in France in a dual degree program. His main interests in the discipline lie mainly in international trade and finance. Shebli is considering an M.A. and Ph.D. in economics after attaining his B.A. and pursuing a career in international trade through an organization such as the World Trade Organization (WTO).

UYSEOK LEE

Bachelor of International Economics

Uyseok is currently in his third year in the Bachelor of International Economics program at the VSE. He is originally from South Korea, but grew up in Canada in Langley, BC. He views economics as a way to approach and solve problems using a set of premises about the fundamental behaviours of people. In his future, he plans to pursue graduate studies in economics, focusing on policy and microeconomic analysis.

SENIOR EDITORS

MELISSA PARLOUR

Bachelor of Arts
Economics Major

Melissa is originally from the United States, but moved to Scotland at the age of eighteen, where she now attends the University of Edinburgh. She is currently on a one-year study abroad program at UBC and in her third year of Economics. Melissa's passion for economics has continued to grow since her junior year in high-school and describes economics as a "beautiful blend of the real world and mathematical models." In her future, Melissa plans to pursue a Masters Degree in development economics.

GREGORY PITTS

Bachelor of Arts
Economics Major and Psychology Minor

Greg is currently in his fourth year studying Economics with a minor in Psychology. He was born and raised in Vancouver, but attended the University of St. Andrew's in Scotland for two years before making the decision to transfer to UBC in Vancouver. Greg enjoys the balance of quantitative and qualitative analysis that is central to economics. His career focus centers on entering into a business capacity, with the option of pursuing economics research through a career with the Bank of Canada or an M.A. in the future.

JUNIOR EDITORS

CONNER BRYAN

Bachelor of Arts
Candidate: Honours Double Major Economics and Philosophy

Conner is currently pursuing the Honours Program of Economics with a key interest in the philosophical intersections regarding the legitimacy of money, price mechanisms, and market design. Conner hopes to continue his education through graduate school and beyond. His primary goal is simply to contribute to the academic discussions of contemporary economics.

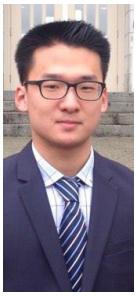
MOHSIN ALI KHAN

Bachelor of Arts
Double Major Economics and International Relations

Mohsin is in his third year at the University of British Columbia, studying economics and international relations. He is originally from Pakistan, and wants to continue on to graduate studies in economics. While he appreciates macro-level economic linkages, especially in cases where international relations and economics meet, Mohsin's true interests lie in microeconomics, specifically in behavioural economics and game theory.

TONY LI

Bachelor of Arts
Combined Major Economics and Political Science



Tony is currently in his third year in the combined major of Political Science and Economics. He was born in Beijing, China and grew up in White Rock, Canada. Tony is passionate about macroeconomics and monetary policies, with a particular interest in the relation between central banking and financial markets. In the future, he plans on pursuing a career in investment banking and investment services.

KIRA MARTIN-CHAN

Bachelor of Arts
Double Major Economics and Political Science

Kira is currently in her third year majoring in economics. After growing up and spending the majority of her life in Vancouver, she took the opportunity to study in France for her first two years in the dual degree program between UBC and Sciences Po. She plans to continue her studies in a graduate program focusing on finance and macroeconomic policy and hopes her involvement in the journal will expose her to some of the many interesting and unique perspectives that economics has to offer.

JUNIOR EDITORS

MIR MUHTADI FAIAZ

Bachelor of Arts
Candidate: Double Major Economics and Political Science

Faiaz is currently in his second year pursuing a Double Major in Economics and Political Science. He is from Bangladesh, a densely populated but beautiful country in South Asia; which is also one of the fastest growing economies in the world. In the future Faiaz wants to graduate from a public policy school and work in the field of international development or academia.

MARIAM NASSER

Bachelor of Arts
Double Major Economics and Canadian Studies

Mariam grew up in North Delta, BC, and is currently in her 3rd year at the University of British Columbia with a double major in Economics and Canadian Studies. She finds economics the perfect mix of everything she enjoys—politics, problem solving, analysis, history and writing. In particular, Mariam is passionate about public economics, specifically within Canada. In the future, she hopes to pursue either a masters degree in public economics or law school, where she would focus on constitutional law and human rights.

BRENDA NGUYEN

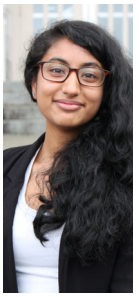
Bachelor of Arts
Double Major Economics and International Relations

Brenda is in her fourth year at the University of British Columbia, pursuing a Bachelor of Arts in International Relations and Economics. She was born and raised in Vancouver but spent the past two years in Edinburgh, exploring and gaining a deeper understanding of the world. In the future, given her educational background and experiences, Brenda is considering pursuing a career in either international trade or development.

RESEARCH UNIT CHAIR

SOPHIA JIT

Bachelor of Arts
Honours Double Major Philosophy and Economics



Sophia is currently in her fifth year in the Honours Program with a dual focus on Philosophy and Economics. Motivated by a keen interest in common sense notions of "justice" and "equality", she chose to incorporate economics in her studies in an attempt to understand the underlying cause of societal issues. For her future, Sophia is interested in pursuing both graduate work in economics and a law degree with the aim of focusing on international justice issues.

PRODUCTION CHAIR

LUELLA SUN

Bachelor of Arts
Economics Major and Computer Science Minor

Luella is currently in her third year of the Economics program, with a minor in Computer Science. She was born in Beijing and grew up in the boonies of Victoria, B.C. In the future, she would like to pursue a M.A in economics, or maybe something fun that combines her passions of art, economics, and technology.

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