PONTIFÍCIA UNIVERSIDADE CATÓLICA DO RIO DE JANEIRO
MONOGRAFIA DE FINAL DE CURSO

THE EFFECTS OF ECONOMIC SHOCKS ON BIRTH OUTCOMES AND INFANT MORTALITY

Evidence from the "Chinese Boom" in Brazilian local markets

Henrique Rodrigues da Mota

Nº de matrícula: 1510352

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"Declaro que o presente trabalho é de minha autoria e que não recorri para realizá-lo, a nenhuma forma de ajuda externa, exceto quando autorizado pelo professor tutor"

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Resumo

Mota, Henrique Rodrigues da; Ferraz, Claudio Abromovay (Orientador). **The effects of economic shocks on birth outcomes and infant mortality: evidence from the Chinese Boom in Brazilian local markets.** Rio de Janeiro, 2018, 53 p.– Departamento de Ciências Econômicas, Pontifícia Universidade Católica do Rio de Janeiro.

Esta monografia estuda os impactos de choques econômicos em resultados perinatais e mortalidade infantil (até 1 ano de idade), a partir dos impactos em mercados de trabalho locais da ascensão das importações e exportações chinesa. Utilizando-se de uma estratégia de Variável Instrumental, encontra-se o efeito causal da exposição das microrregiões do Brasil ao "Boom da China" em saúde infantil. Choques econômicos positivos trazidos pelas exportações à China são associados a maiores pesos médios no nascimento e menores proporções de nascimentos com baixo peso (menos de 2500 g), muito baixo peso (menos de 1500 g) e extremo baixo peso (menos de 1000 g). Choques econômicos negativos da competição trazida pelas importações advindas da China reduzem a duração da gestação, incrementando a parcela de nascimentos com bebês extremamente prematuros (menos de 28 semanas), além de contribuir para o aumento da mortalidade causada por doenças infecciosas, por causas desconhecidas e por má nutrição. Os resultados são robustos, exceto para as variáveis de mortalidade. Esta monografia também explora possíveis mecanismos: choques econômicos aumentam a parcela de mães com melhor educação, enquanto os negativos favorecem a parcela das menos educadas, reduzindo também o número de visitas pré-natais. Canais do mercado de trabalho local são considerados, mas estes parecem ser relevantes apenas para explicar as variações nos partos prematuros.

Palavras-chave

Choques econômicos; choques comerciais; saúde infantil; resultados perinatais; mortalidade infantil.

Abstract

Mota, Henrique Rodrigues da; Ferraz, Claudio Abromovay (Advisor). **The effects of economic shocks on birth outcomes and infant mortality: evidence from the Chinese Boom in Brazilian local markets.** Rio de Janeiro, 2018, 53 p.– Departamento de Ciências Econômicas, Pontifícia Universidade Católica do Rio de Janeiro.

This paper studies the impacts of economic shocks on birth outcomes and infant mortality (deaths up to 1 year old) by exploiting the Chinese export and import boom effects on Brazilian local labor markets. By using an IV approach, I found the causal effect of the exposure of a Brazilian micro-region to the "Chinse Boom" on infant health. Positive economic shocks moved by exports to China are associated with higher newborns' weight and lower share of births with low weight (less than 2500 g), very low weight (1500 g) and extremely low weight (1000 g). Negative economic shocks moved by competition from imports from China reduces gestational length, increasing the share of extremely premature births (less than 28 weeks), and contribute to higher mortality rates caused by infectious diseases, unknown motives and by malnutrition. These results are particularly robust, except for mortality variables. This paper also explores possible mechanisms: positive economic shocks seem to contribute to the share of births belonging to higher-educated mothers, while negative ones cause higher share of lower-educated mothers and reduced antenatal visits. Labor market channels are considered, but they seem to be relevant only for explaining variation in extremely premature births.

Keywords

Economic shocks; trade shocks; infant health; birth outcomes; infant mortality.

CONTENTS

LIST OF TABLES

LIST OF FIGURES

I. Introduction

Changes in economic conditions may play a significant role on changes in infant health and mortality. The income-health gradient suggests that the improvements in economic circumstances leads to better health status for people. Nonetheless, this well-stablished statistical relationship is not necessarily causal and recent literature on the causal impact of economic shocks may show different patterns of behavior. Evidence for developed countries indicates that periods of economic expansion may lead to an increase in mortality and general worsening of health indicators (Ruhm, 2000, 2004, 2005; Neumayer, 2004; Dehejia and Lleras-Muney, 2004). For developing countries, however, the prevailing evidence is that economic expansions improves infant health and reduces mortality (Cutler et al., 2002; Stillman and Thomas, 2004; Paxson and Schady, 2005; Bhalotra, 2010; Baird, Friedman and Schady, 2011; Bozzoli and Quintana-Domenque, 2014; Gutierrez, 2017), although there can be notable exceptions (Miller and Urdinola, 2010). Therefore, understanding how, and by through which mechanisms, economic shocks (temporary or permanent) contribute (or not) to the general improvement of birth outcomes and infant mortality remains an important empirical question on both economic and medical literature.

This paper studies the impacts of economic shocks on infant health (birth outcomes) and mortality (deaths up to 1 year old) by exploiting the Chinese export and import boom effects on Brazilian local labor markets. The "Chinese Boom" has been a significant episode in the country's recent economic history. As noted by Costa, Garred and Pessoa (2016), the impacts were big: in 2000, imports by value from China represented only 2.3% of total Brazilian imports, while exports represented only 2.0%; in 2010, those shares were respectively 14.5% and 15.1% in 2010. Such a tremendous rise in Chinese goods in Brazilian trade has provoked mounting animosity by many, especially those associated with protectionism interest groups.[1]

Moreover, Brazil's own economic and geographic diversity, as well as its wide dimension, offer an environment with great level of different local economies. This in turn leads to quite heterogeneous sensitivities of local economic performance and different spatial consequences of the Chinese trade shock. As also noted by Costa, Garred and Pessoa (2016), areas most affected by competition shocks from Brazilian imports from China (manufacturing

[1] Former Minister of Treasury during the military dictatorship years, Delfim Netto, has even claimed that Brazil has turned in a "colony of China" (*28th of April 2018 – Isto É Dinheiro, available on: https://www.istoedinheiro.com.br/o-brasil-nao-e-um-fracasso/)*.

regions) have seen lower salaries' growth while local markets most exposed by the demand shocks (regions of soybean producers or iron ore miners) from Brazilian exports to China have seen higher wage growth. These economic effects, in turn, may have deep consequences for health status of infants in the different local markets across the country.

To estimate the reduced-form causal impact of import competition shocks and export demand shocks on birth outcomes and infant mortality, in the context of local labor markets, I utilize the proposed methodology and dataset of Costa, Garred and Pessoa (2016), combining it with rich microdata on live births and mortality from Datasus, the integrated database of Brazilian national healthcare system. For this paper, the unity of analysis are Brazilian micro-regions, which has been widely used as a close proxy to local markets in Brazil. As a baseline for this empirical strategy, I use a First Differences (FD) model with shock variables controlling for state-specific trends (due to Datasus dataset particularities, which will be better explained in the next sessions). Since it uses a FD model, this baseline strategy already controls for observable and unobservable fixed effects across time and space.

Using the FD model, I find that the demand and competition shocks from China have statistically significant effects on the share of very low weight (less than 1500 g) and extremely premature births. Nonetheless, these results are not robust when controlling for the impact of economic and healthcare initial conditions on trends in health outcomes. However, since this paper's main objective is to estimate the causal effect of the "Chinese Boom" in Brazilian local markets, it is important to guarantee that the variables used to estimate the impacts of competition and demand are, in fact, exogenous. For this purpose, I use an instrumental variable (IV) strategy that filters these shock variables of other Brazilian-specific demand and supply variations and World-level shocks correlated with the Chinese ascent in global trade. This IV strategy is the preferred approach on this paper.

Results for this IV model are higher in magnitude and more statistically significant and robust than the original FD model. In our most conservative estimate, when controlling for possible effects of economic and healthcare initial conditions on future trends of infant health, I found that the export-related demand shock (positive shock) has caused general improvement of the average weight in Brazil, while reducing the share of low weight, very low weight and extremely low weight births (less than 2500 g, 1500 g and 1000 g, respectively). Moreover, I found that the competition shocks (negative shocks) have increased the share of extremely premature births. If faced with an increase of one SD in the demand shocks, the average micro-

region in our dataset would have faced a decline 13.7% smaller[2] in average weight of newborns, between 2000 and 2010, while the increase in the share of low, very low and extremely low weight births would have been, respectively, 9.6%, 9.5% and 8.6% less intense[3]. For its part, a one SD variation on the competition shock generates an additional growth in extremely premature births equivalent to 25.9% of the average increase of this outcome between 2000 and 2010[4].

For both models, FD or IV, there is some suggestive evidence, based on point estimates, that demand shocks reduces general infant mortality rate while competition shocks increase it. In a less conservative estimate, the results are significant for the impact of competition shocks on deaths caused by infectious diseases and by unknown motives, but they are not robust. On the IV model, considering the average micro-region, a one SD increase in the competition shock would have reduced the fall of infant mortality caused by infectious diseases in 17.5% and the decline of infant mortality caused by unknown motives in 30.1% between 2000 and 2010[5]. Nonetheless, these results are not robust for controlling to the possible impacts on future health trends of the initial economic and healthcare conditions.

At least two identification problems may emerge when it comes to this empirical endeavor of estimating the impacts of changes in economic conditions on health. One of them might be an *omitted variable* problem; for example, technological development or institutions may cause both good health outcomes and economic growth. On the other hand, there may be a problem of *reverse causality*; strong health outcomes promotes raises on productivity, wages and income. Indeed, in a development economics perspective, there is evidence that healthier societies lead countries to higher growth. Nutrition may have been crucial for economic growth of now developed nations in the 19th century (Fogel, 2004). Moreover, diseases from AIDS to Malaria and high mortality may have negative economic effects in developing countries (Bloom and Sachs, 1998; Gallup and Sachs, 2001; WHO, 2001; Sachs and Malaney, 2002; Lorentzen, McMillan and Wacziarg., 2008) creating some sort of health poverty trap. On the particular case of child and infant health, Black, Devereux and Salvanes (2007) find that a baby's weight has long run impacts on its education, IQ and future earnings, while Heckman (2007) notes that

[2] An increase of 3.81 grams divided by an average variation of -27.67 grams.
[3] That is, respectively: an impact of -0.075 p.p. divided by a variation of 0.776 p.p.; an impact of -0.029 p.p. divided by 0.307 p.p.; and an impact of -0.016 p.p. divided by 0.307 p.p.
[4] Na increase of 0.029 p.p. divided by an average variation of 0.115 p.p.
[5] Respectively, an increase of 0.175 death per 1,000 live births divided by a reduction of 1 death per 1,000 live births and an increase of 0.628 deaths per 1,000 live births divided by a decline of 2 deaths per 1,000 live births.

early childhood health interacts with the formation of cognitive and non-cognitive skills, key determinants of future earnings.

Fortunately, it is highly unlikely that this paper's empirical strategy may have the problems cited above. On the omitted variable concern, it is implausible that any particular variable could have caused both changes in health outcomes across time while being correlated with specific initial sectorial economic characteristics, which are, essentially, what affect local market sensitivities to the "Chinese Boom". This is even truer for this paper's conservative estimates, since I control for possible impacts of several healthcare and economic initial conditions on infant health trends and few changes are found in estimates compared with less demanding specifications (at least for birth outcome variables).

On the reverse causality concern, it is very clear that child and birth health trends in the future do not affect local markets particular sensitivities to China's emergence in global markets. Initial specialization on particular sub-sectors, for example, soybean agriculture or iron ore mining, determines sensitivities of local markets to Chinese shocks. In order to health outcome variations have any causality on the exposure to the "Chinese Boom", future trends in infant health outcomes should have been a factor considered by entrepreneurs in order to specialize in a particular sub-sectorial level. Except for some few medical sectors, these future health trends are not serious determinant for regional specialization. In other words, the rises of Chinese imports and exports are probably exogenous shocks to infant health in the local economy level. This seems to be even closer to the truth when using the previously cited IV strategy, since it filters any variation of the competition and demand shock coming from other inside-Brazil or World-level shocks.

After having analyzed the direct effect of the trade shock on infant health outcomes as well as on child mortality, this paper sheds light on the possible the possible mechanisms through which this happen. I analyze the mechanisms of maternal composition (its educational characteristics and health-seeking activities) and labor market variables. Mothers with different levels of education, salaries and marital status may have different sensitivities to income when making its fertility decisions; thus, economic shocks may alter the composition of mothers that decide to have babies (Perry, 2004; Chevalier and Marie, 2015). I find that negative economic shocks are indeed associated with an increase in the share of total births belonging to lower educated women (those with no schooling), while positive shocks contribute to an increase in the share of births from higher educated mothers (those with 12 years or more of schooling).

These results are robust and may contribute for the weight gain estimated on this paper. For health-seeking activities such as antenatal visits, there is some evidence that the competition shock causes reduced the level of visits by mothers, but it is not robust. For labor market characteristics, it seems that competition shocks increase employment while reducing salaries and this, in turn, seems to explain part of the rise in extremely premature births, but there are no clear relation between the labor market and other variables. Results for channels are certainly not definitive and need further investigation.

The remaining parts of this paper are structured as follows. Section II provides the theoretical framework, reviewing previous literature, and elaborate on its relation with the main subjects of this paper. Section III describes data that will be utilized on this paper; particular attention was given to the specifics of live births and mortality database. Section IV describes the empirical methodology and the results for the FD and IV model related to the reduced-form causal effect of the "Chinese Boom" in infant mortality and birth outcomes. Section V consider the mechanisms through which shocks affect infant mortality, Section VI discusses the results of estimates and contrasts it with previous results in literature, while Section VII concludes.

II. Theoretical Framework

This paper is largely motivated by a growing theoretical and empirical literature on the relationship between economic shocks and health. From a theoretical perspective, the impact of economic shocks on healthcare outcomes may operate on both directions. The seminal works of Grossman (1972) and Gronau (1977) highlight that both *income* and *substitution effects* are into play when it comes specifically to the impacts of income on health. Increases in market wages and market level of employment may certainly increase the purchase of "health goods and services" such as healthy foods, prescription drugs and medical treatments. Nonetheless, since the nonmarket production of many health inputs demands significant amount of time, the increase of salaries can very well raise the opportunity costs of health-improving activities, such as the practice of exercises, the travelling time to preventive medical visits and stress reducing leisure. It is important to notice that childcare is possibly much more time consuming than financially demanding; Vistnes and Hamilton (1995) notes that higher hours worked by mothers and increased time costs leads to reduced clinical visits.

In developed countries, when analyzing short-term variations in economic growth, after the early and heavily criticized contributions of Harvey Brenner showing a countercyclical pattern of mortality, an increasing amount of empirical work both on economic and on medical literature has supported the thesis of procyclicality , which means that positive temporary economic shocks may cause an increase in mortality. Ruhm (2000, 2004, 2005), controlling for state-fixed effects in the United States, notes that recessions are correlated with reductions in general mortality of the population and with improved health habits, such as lower smoking and drinking. Neumayer (2004) confirms most of Ruhm's finding using data from Germany; economic bursts negatively correlates with general and age-specific mortality, as well as for mortality from cardiovascular diseases, pneumonia and influenza, motor vehicle accidents and suicides.

In developing countries, some authors emphasize that mortality and bad health maybe countercyclical or that positive economic (short term or long term) shocks improve health outcomes (Sen, 1981; Dréze and Sen, 1990). They argue that economic recessions or negative structural shocks may cause serious episodes of hunger and mal nutrition; this is justified by dysfunctional markets and credit restraints, which reduce consumption smoothing across time, especially in poorer and more vulnerable households. Moreover, poverty makes families more vulnerable to climatic variations, especially on rural areas; Rocha and Soares (2015) notice that,

in Brazilian Nordeste region, municipalities with higher incomes are much less subject to infant mortality increases caused by reduced rainfalls and drought. Nonetheless, many other empirical findings corroborate with a procyclical behavior of health, at least for temporary shocks. Mwabu (1988) highlights that better economic conditions may raise the shadow price of time, and, thus, reduce individual attention to healthcare.

On the particular subject of child health, evidences are mixed. According to a wide review of recent literature authored by Ferreira and Schady (2009), while in developed countries, positive income shocks tend to be associated with poorer health outcomes for children, in developing countries, recessions generally mean higher child mortality rates and poorer health. In the United States, Tapia Granados (2005) finds that episodes of economic expansion were usually met with increased mortality, including infant and early childhood mortality. Dehejia and Lleras-Muney (2004), studying the relationship between unemployment at the time of baby's conception and infant outcomes, finds that higher unemployment is associated with improvement of baby's health. Importantly, these authors also investigate what are the mechanisms involved on this phenomenon; they find that both composition effects (black women averting births) and healthier parental behavior are important drivers on the improvement of their descendants' well-being. Nonetheless, in Denmark, a very rich country with a robust social safety net, Wüst (2015) finds that unemployment in the first trimester of births generally reduces the length of gestation. The author believes that maternal stress caused by unemployment may be the main channel through which economic shocks may affect birth outcomes.

In the developing world, however, results are quite different from the developed countries, safe this "Danish" exception. Using DHS Survey data for 1.7 million births in 59 developing countries, Baird, Friedman and Schady (2011) find robust evidence that negative aggregate income shocks, short-term cyclical variations, has a positive impact on the mortality. They found that a decrease of 1% in GDP *per capita* might increase infant mortality between 0.24 and 0.40 per 1,000 children born. Results for female mortality are even stronger, while male infant mortality tends to be less sensitive to an economic crisis. In rural India, Bhalotra (2010), following similar methodology and using DHS data, finds strong positive relation between income and infant health, also noting that girls are usually the most affected by an economic crisis. The author also analyses possible mechanisms for this causal effect of aggregate income shocks in mortality; in his analysis, he found that recessions reduces health-seeking activities while increasing the participation of women in labor markets.

Examining the episode of high economic volatility in Russia in the early 1990s, Stillman and Thomas (2004) notice that positive economic shocks have impacts not only in the level of calories ingested by adults and children but also may affect the body mass of adults and the weight and height of children. Moreover, the authors show that effects of permanent income shocks are much more intense than transitory ones, with households substituting diary, meat, fruits and vegetables with starches (a heterogeneous group of carbohydrates like bread and pasta). Nonetheless, the authors acknowledges that poorer households are more sensitive to income changes, with transitory shocks affecting intensively young girls in poor households.

For countries similar to Brazil, Latin American middle-income nations, there is also evidences that positive economic shocks generate virtuous result for infant health and mortality. Exploring the Argentinian economic crisis of the early 2000s, Bozzoli and Quintana-Domenque (2014) find evidences that birth weights are procyclical. More importantly, the authors considers differential effects for higher educated mothers and for lower educated ones; with the worst results centered in mothers that have not completed high school. Since the latter group is definitely more subject to credit constraints, it is harder for those women to smooth consumption across time, making them particularly more vulnerable to an economic crisis. Authors investigate two specific channels: maternal malnutrition, which tends to affect development in the third trimester of pregnancy, and maternal stress, which is particularly relevant for birth weight in the first trimester of intrauterine development. The two channels affect poorly educated mothers, while stress is the only channel through which higher educated women may be affected by an economic crisis.

Moreover, in Mexico, Cutler et al. (2002), following a difference-in-difference model and using young males as the control group, show that infant mortality suffered increases due to the economic crisis of 1995-1996. Studying the possible channels for this phenomenon, the authors consider that the income shock was the predominant reason for rising mortality. In Peru, Paxson and Schady (2005) acknowledge that the severe economic downturn of the early 90s caused about 17,000 excess deaths in the year of 1990. Dismissing terrorism and the outbreak of cholera as the main reasons for increased infant mortality, they notice that the economic crisis provoked a significant reduction of healthcare services by government and cite this as the main cause for higher death rate of infants. As an exception, Miller and Urdinola (2010) shows that child and infant health largely worsen in rural Colombia when coffee prices rise; the authors argue that this is mainly due to increased wages, which causes parents, and especially mothers,

to reduce time-intensive childcare in favor of working. Ferreira and Schady (2009), however, suggests that results found in Miller and Urdinola (2010) may be implausibly big.

Nonetheless, the issue about what is the robust relation between income and health is largely unsettled. Thus, this empirical literature certainly needs more findings; this paper seeks to contribute with this, by bringing evidences from the causal impacts of China emergence in global markets in Brazilian birth outcomes and infant mortality.

Furthermore, mothers particular characteristics and mothers' particular sensitivities to economic shocks mediate those effects on infant health. For example, a recession may increase relative fertility of poor women, which in turn may cause a reduction in average birth weight and higher infant mortality rates. Episodes of recession or high economic uncertainty are often associated with selection of births in favor of less educated women (Perry, 2004); which in turn can have negative impacts on their children outcomes in the short run and in the long run. Chevalier and Marie (2015) notes that the period of deep economic and politic uncertainty of the fall of the Berlin Wall has lead a significant drop of fertility in East German on which mothers with poorer observed characteristics (younger, less educated, less active and more often on welfare) increased its presence in the share of births. This, in turn, generated a generation of children with poor educational outcomes, growing in less stable households.

Although not considering it as the main mechanism through which the economic crisis in Peru affected infant health, Paxson and Schady (2005) agrees that recession caused some selection in favor of high-risk mothers (i.e., those with higher risks of losing a child in the first 12 months of its life). However, these results are not always evident, regardless of the income level of each country. Bhalotra (2010) notices that economic downturns in rural India are often associated with reduced fertility of high-risk mothers. As already said, in the US, Dehejia and Lleras-Muney (2004) notices that black mothers, who usually come from poorer and less educated upbringings, are usually the ones with reduced fertility. Hence, maternal composition of live births may change during economic shocks in the short and the long run. The episode of the "Chinese Boom" also provides an opportunity to study this matter.

Moreover, this paper can be partially associated to a relatively large literature on economics of trade and its impacts in local labor market outcomes in Brazil, especially because of its use of similar empirical methodology (Kovak, 2013; Dix-Carneiro, 2014; Dix-Carneiro and Kovak, 2015a; Dix-Carneiro and Kovak, 2015b). More specifically, this paper contributes to an emerging literature that seeks to understand possible non-labor market related impacts of

trade shocks in Brazil, such as crime (Dix-Carneiro, Soares and Ulyssea, 2017). For the particular context of Brazil, I could not find any recent paper that studies the impacts of trade shocks on health outcomes, meaning that this paper will be unique on its purpose.

III. Data

Local Economies

The analysis conducted on this paper focus on adapted IBGE micro-regions, which are contiguous municipalities that share similar economic, geographic and productive attributes. Those boundaries are a close approximation of the idea of local markets and they have been widely used by researchers who study the impacts of trade in Brazil. Using original IBGE mappings is not possible and changes are needed since municipalities are created and extinct over time, while its border are quite often changed. Hence, alternative mapping is used, in order to guarantee time consistency of this paper's unity of analysis. The local economies considered on this paper are the same utilized by Dix-Carneiro and Kovak (2015b), Costa, Garred and Pessoa (2016) and Dix-Carneiro, Soares and Ulyssea (2017). Those are 413 time consistent IBGE micro-regions, based on the contributions of Reis, Pimentel and Alvarenga (2007) on the creation of minimal comparable areas across time. Several information concerning workforce characteristics and local market dynamics, such as income *per capita*, and the sectoral composition of labor are also collected from Costa, Garred and Pessoa (2016) dataset. I drop the Fernando de Noronha micro-region.

Economic Data and "Chinese Boom" shocks

Economic characteristics of local markets are extracted from Costa, Garred and Pessoa (2016). The local competition shocks caused by Brazilian imports from China (IS) and the demand shocks caused by Brazilian exports to China (XD) are also the same of the ones used by Costa, Garred and Pessoa (2016), as well as its Instrumental Variables, which are going to be explained on the next section. By each micro-region m, the export- and import-related shocks read as follow:

$$XD_m \equiv \sum_j \frac{L_{mj,2000}}{L_{Bj2000} L_{m2000}} \Delta X_j$$

$$IS_m \equiv \sum_j \frac{L_{mj,2000}}{L_{Bj2000} L_{m2000}} \Delta I_j$$

Where the variable $L_{mj,2000}$ stands for the size of the labor force in sector j within m in 2000, while L_{m2000} and L_{Bj2000} represent, respectively, the total workforce in the micro-region and

in Brazil. ΔX_j stands for the total variation from 2000 to 2010 on sectorial j exports from Brazil to China, $\Delta X_j \equiv V_{CjB,2010} - V_{CjB,2000}$, while ΔI_j means the same, but for imports of Brazil from China. Costa, Garred and Pessoa (2016) denominate both XD_m and IS_m in thousands of 2010 US dollars per worker. In effect, these two variables are not actually *stricto sensu* local shocks variables, but exposure variables to national shocks.

Infant Health and Child Mortality

I use a similar approach to Rocha and Soares (2015) in order to construct infant health and child mortality dataset. For this purpose, I use microdata from Brazilian National System of Information on Birth Records (Datasus/SINASC) and the Brazilian National System of Mortality Records (Datasus/SIM) for the years 2000 and 2010. SINASC offers a very complete database with information about every registered live birth in Brazil. It collects data on birth outcomes, such as the newborn's weight, its Apgar score and its gestational length. It also provides the newborn gender, race and date of birth as well as the place of its birth and the place of residence of its mother. Moreover, there a significant amount of maternal information, such as its age, marital status, educational attainment, job market occupation (although this particular variable has a large share of missing data) and number of previous children which are dead and which are alive. The latter set of information can be particular useful for controlling and analyzing possible composition effects, since mothers preferences on fertility may have different elasticities for economic shocks, depending on its education, age and occupation.

This paper uses SIM dataset for analyzing infant mortality rates across local markets. SIM gathers information of all registered deaths in Brazil; it collects many characteristics of dead individuals, such as their date of birth and death, gender, sex, age, municipality of residence and birth and cause of death, as classified by the ICD.

I combine both datasets and aggregate data on this micro-regional level. This aggregation contains averages of birth weight and APGAR score. Proportion variables (e.g, percentage of total births with weight lower than 1500g or the percentage of premature births) are also generated. I also estimate micro-regional levels of infant mortality rate (child deaths up[6] to the age of one per 1,000 live births). Estimates with mortality for specific causes of death, as they are classified by the ICD, are also used.

[6] I consider deaths up to 1 year old rather than the usual definition of deaths under 1 year old.

It is important to notice that on both SINASC and SIM, but especially on the first dataset, missing data is very low, and for the years of our analysis, the range of the registration system is good. Nonetheless, there is some reasonable amount of coverage heterogeneity across states, which usually motivates government agencies in Brazil not to produce mortality estimates by the direct method (dividing SIM data with SINASC data) that I use (Flores, 2009). For this reason, this paper's specification will control for state fixed and state specific trend effects, so that we can compare micro-regions with the similar sub-registration patterns.

Other Data

Furthermore, to control for initial health conditions, I also use data from Datasus of hospital and hospital bed availability. Moreover, concerning initial availability of health facilities and high-skilled health-related workforce, I use data from the 2002 Survey on Medical and Sanitary Assistance (*Pesquisa de Assistência Médico Sanitária* de 2002, in short, PAMS 2002). Census data is used to estimate the proportion of population with access to sewage systems, and information on two important Federal community health programs (the Health Community Agent Program (Programa Agente Comunitário da Saúde, in short, *ACS*) and Family Health Program) of Brazil is collected from the Basic Assistance Department (Departamento de Assistência Básica, in short).

Table 1, in the Appendix, summarizes some of the most important statistics of this Paper dataset, in the year 2000. As we can notice by this table, the Chinese shocks are far from orthogonal to the micro-regional initial conditions on health outcomes and infrastructure, as well as on maternal and child attributes. Local markets that are more intensely affected by both Chinese import supply shocks and export demand shocks seems to show better APGAR scores than the whole sample average. Moreover, when it comes to health infrastructure, IS Top Quantile micro-regions shows statistically significant higher levels of well-educated health professionals per 1,000 people when compared to the whole sample. Sanitation levels are much higher as well. Differences are also seen when it comes to coverage on federal government health programs, maternal composition and racial composition of children. Vaccinal coverage show some variation when it comes the different samples, but this variation is often small or not statistically significant. Since these initial conditions can affect future trends on health outcomes and mortality, it is important to control for this variables in this paper's model, at least for robustness tests, as it is going to be explained in the next section.

IV. Birth Outcomes and Infant Mortality: Models and Results

a. Baseline Models

The empirical strategy follows quite closely Costa, Garred and Pessoa (2016) and relates child and infant health outcomes with those locally heterogeneous shocks of competition by imports from China (IS_m) or of demand by exports to China (XD_m) ; this means that this study baseline specification is as follows:

$$\Delta H_{m,10-00} = \beta_0 + \delta_I IS_m + \delta_X XD_m + \mu_s + \varepsilon_m$$

On the left hand side of all regressions, $\Delta H_{m,10-00}$ stands for variation on an infant health or child mortality specific variable from 2000 to 2010. There is a big set of variables which will be considered on this papers' regression, as already outlined in the Data Section; H_m may be the average newborn weight of the micro-region, the average Apgar, the average gestational length, or even infant mortality rate of the micro-region. As already seen in the data section, variables IS_m and XD_m are "variations" (or, more precisely, exposure to national "variations"), so it is perfectly possible to consider this baseline model as a first-difference (FD) model. For this reason, the baseline model already controls for fixed-effects across time and space.

The coefficients of interest in this analysis are both δ_I and δ_X, which outline the reduced-form impact of the competition and demand shocks on infant health and mortality. My main goal is to obtain for unbiased estimates for these coefficients, since I am willing to estimate the causal effects of these two "Chinese Boom" shocks. Results on this first regression analysis may operate on both sides. As already cited in the Theoretical Framework, if income effects are prevalent, a negative relation between economic downturns and disease and mortality is expected; i.e., it is possible that competition from imports increase mortality and worsen infant health, while demand shocks do the opposite, promoting growth and improved health. Nonetheless, substitution effects may be strong, growth may worsen outcomes of children, since salaries may raise the opportunity costs of taking care of a mother's health and of its children, provoking increased diseases.

As already mentioned, I will use state specific trend effects (μ_s) to deal with possible selection bias from failed coverage and differences in coverage progress from SINASC and SIM. As already noted, state fixed effects are already controlled for in a FD model, but since

the expansion of coverage of SINASC and SIM has also seen differences across states, controlling for state specific trends is very important to guarantee unbiased estimates. Although I do not report this results, the lack of control for state specific trends often generate statistically significant coefficients for import and demand shocks in the same direction, which is certainly not possible based on the complete opposite economic directions that these two shocks have had in Brazilian local markets. Moreover, by clustering the robust standard errors in the meso-regional level, I allow some level of correlation between economic shocks across micro-regions. All results are weighted by share of national live births in 2000.

As it is possible to see in Table 2 (available in appendix), where health outcome related with Weight, Gestational Length and APGAR Score are analyzed, there is some prevailing evidence that there is a positive relationship between economic shocks and health outcomes, i.e., better economic conditions generates better infant health outcomes. As it is noticeable by results in Panel As of Table 2, the demand shocks generated by exports to China (XD) caused an improve on newborn weights at birth, while also reducing the percentage of very low weight births (less than 1500 grams). A micro-region that faces a one SD increase on its XD shock will see an additional improvement of 3.59 grams on the average birth weight and a reduction of 0.032 percentage points in the share of live births with low weight between 2000 and 2010. While these results may seem small, they represent for an average micro-region, respectively, a reduction of 12.97% in the drop of the average weight registered between 2000 and 2010 (-27.7 grams) and a reduction of 10.35% in the rise of percentage of very low weight births (0.307 percentage points.), which means that these results that are from negligible. More importantly, since I cannot detect impacts of a positive economic shock in the share of low weight births (less than 2500 grams) while finding for very low weight births, results are suggestive of a concentration of weight improvements especially between newborns that are more vulnerable.

In Panel B, it is also possible to see that negative income shocks, like a supply shock caused by imports from China (IS), causes shorter gestational periods. A one SD increase on the micro-regions' IS shock causes an increase of 0.031 in the share of extremely premature births (less than 28 weeks) between 2000 and 2010. This represents an additional increase equivalent to 27% of the rise of premature births seen in the national average (which was of 0.115 p.p.). Panel C, nonetheless, does not show consistent evidence of the direction of the impacts of income on Apgar Scores. While no significant impacts are seen to the average Apgar score in the 1st and 5th minute of birth, there are significant coefficients with regards to the share of newborns with low Apgar 1 and 5 (below 8). These coefficients for percentage of live births

with low Apgar 1, however, operates in the same direction, showing no clear pattern for the impact of economic shocks on infant health. Fortunately, for Apgar 5, we see poor economic circumstances leads to increases in the share of births with low Apgar score. These results for Panel C need to be seen in a conservative perspective, since there is a high level of non-available APGAR information of births in the 2000's SINASC dataset (higher than 10% while for most variables it tends to be much less than 5%).This may bias the results in unpredictable ways.

As we can see in Table 3, point estimates for the impact of economic shocks in the total infant mortality rates are in line with evidence of Table 2. The IS shock has a positive coefficient, while the XD shock has a negative one. These effects, however, are not statistically different from zero. Nonetheless, if we look by separated causes of death, it is possible to see some results with statistical significance. As observed in columns (3) and (7), there is evidence that mortality for infectious diseases and unknown causes increases in the event of an IS shock. In column (2), there is even some marginally significant evidence of deaths for infant malnutrition increasing due to a negative economic shock.

These results means that, if hit by an IS shock one SD stronger, the average micro-region of our sample would see shrunken reductions of mortality rates caused by infectious diseases, non-reported motives and malnutrition between the years 2000 and 2010. Respectively, the drop in mortality rates would be 19.8%, 28.8% and 13.8% less intense[7]. For XD shocks, results are only marginally significant (significant at a 10% level) and not all of these are negative, as was expected with the other evidence of Table 2 and Table 3. Nonetheless, based on point estimates, the reduction in perinatal deaths seems to outweigh by far the sum of increases in respiratory deaths and in deaths motivated by unknown results.

b. Robustness Tests

The baseline model previously presented, although being able to control for specific state trends and for micro-regions' fixed effect, may still show some limitations. For this reason, I use the following model for Robustness Tests:

$$\Delta H_{m,10-00} = \beta_0 + \delta_I IS_m + \delta_X XD_m + \gamma C'_m + \mu_s + \varepsilon_m$$

[7] Respectively, an increase of 0.198 death per 1,000 live births divided by a reduction of 1 death per 1,000 live births; an increase of 0.602 deaths per 1,000 live births divided by a decline of 2 deaths per 1,000 live births; and about 0.046 death per 1,000 live births divided by a fall of 0.337 death per 1,000 live births.

C'_m is the vector of control variables associated with initial economic and healthcare conditions that may affect future trends in health outcomes and infant mortality. Omitting them, as I do in the baseline model, may bias my results. For example, if there is some sort of reversion to the mean when it comes to health across micro-regions, a poorly controlled estimate for the supply shock (which tend to affects micro-regions with better initial health conditions) may result on a negative $\hat{\delta}_I$, even if the true parameter was actually zero or positive.

Following closely the specification of Costa, Garred and Pessoa (2016), the vector of variables takes into consideration many important economic conditions; it includes the size of the local workforce, the share of employed in informal jobs, the proportion of rural residents, and a cubic polynomial of income *per capita*.. Incrementing this set of controls for this papers' particular context, I include a set of variables for initial health conditions. This includes vaccination coverage for BCG, DTP, MMR, Polio, Hepatitis B, Haemophilus Influenzae B, vaccines taken at an early age (less than 1 year old). I also control for the number of hospitals, hospital beds and high-skilled health professionals per 1,000 people. Coverage for Federal Government programs based on community health is also a factor of control, such as PACS and PSF. I also consider the size of the population since it plays an important role in the demand of healthcare services.

In Table 4, I restrict the analysis only for those variables of Table 2 that had already shown statistically significant results. First, I control only for healthcare economic conditions and then I add controls for economic conditions. As it is possible to see, FD baseline model results are not robust, except for the impacts of XD shocks in the reduction of very low weight births. The impacts in the share of births with low Apgar in the first 5 minutes of life and in the average weight is not robust by any specification. Results for IS impacts in Extremely Premature births shrink in dimension and keep only marginal significance when adding healthcare initial condition controls; results are not significant when all controls are added. A similar pattern occurs for the share of births with low Apgar in the first 5 minutes when it comes to the XD coefficient: the dimension of the coefficient shrinks by half. The results are counter-intuitive to the general prevailing evidence noticed. If results were in accordance with what was observed in other health outcomes, XD shocks should cause a reduction, rather than the observed increase, on this share of births with Low Apgar in the first minute of life. However, when adding controls for economic conditions, this "awkward" coefficient losses economic and statistical significance.

Even for results in the share of very low weight births, while the XD shock is still significant at a 5% level with all the controls, the dimension of the coefficient is certainly smaller. By this new estimate, in the event of a one SD increase in the XD shock, the average micro-region would see an increase 6.9% less intense in the share of very low weight births between 2000 and 2010. In contrast, in the FD baseline model, the reduction on intensity was equivalent to 10.35%.

In Table 5, controlling already for both economic and healthcare conditions, results are mixed for mortality. The effect of IS shocks in mortality by unknown motives has reduced on its dimension and lost its statistical significance, while infectious mortality is still significant, but only at a 10% level. Nonetheless, deaths by malnutrition have increased by size and the coefficient for IS shocks on infant mortality caused by this cause of death is now statistically significant at a 1% level. Results for XD shocks are also not consistent; the estimated coefficient for perinatal mortality is now close to zero and lost its statistical significance. Results for respiratory deaths are quite similar while those for deaths motivated by unknown motives has seen a change in the direction of the estimated impact of the XD shock, now having a negative impact in mortality; in both cases, results are only marginally significant. One important aspect of the coefficients related with the general infant mortality rate is that, although point estimates are now close to zero, they still keep the same pattern: IS shocks are positively related with mortality while XD shocks have a negative relation.

c. Instrumental Variables

On this sub-section, I now turn to my preferred specification. Since the purpose of this paper is to find out the causal effect of the Chinese Shock in birth outcomes and infant mortality rates, it is important to guarantee that other economic shocks that may be correlated with the IS and XD variables and that are relevant to healthcare outcomes are properly controlled. One approach for proper identification of the Chinese Shock is using instruments built and used by Costa, Garred and Pessoa (2016). These instrumental variables for the demand and competition shocks are based on the patterns of trade of China with all other countries between 2000 and 2010, excluding Brazil and filtering the effect of world-level shocks on prices and quantities. By using this strategy, it is possible to remove the influence from internal supply and demand shocks in Brazil that may have affected trade with China, as well as the influence from world-level shocks. In practical terms, I use a 2SLS model to make the estimates of IS and XD shocks.

Table 6 focus on weight related variables and extremely premature births. Those are the most relevant and robust results from this paper. Additionally, they are the ones that differ the most from the original FD specification. Although not reported on this paper, variables related with Apgar score and premature births follow very similar patterns with the FD specification. For this specification, impacts on low weight births and extremely low weight births are now statistically significant in the baseline-equivalent specification (controlling only for specific state trends) and are robust for economic and healthcare controls. Moreover, results for Average Weight and Extremely Premature births are now, not only significant at the baseline, but are also robust with controls for initial conditions.

Considering the most conservative estimates, with controls for economic and healthcare initial conditions, we find economically significant effects for the Chinese Boom on birth outcomes. With an XD shock one SD stronger; the average micro-region would have faced a much less intense increase in births with low weight as well as a smaller drop in newborns' average weight. Between 2000 and 2010, the drop in average weight would be 13.7% smaller[8] and the increases in low, very low and extremely low weight births would be, respectively, 9.6%, 9.5% and 8.6% less intense[9]. An IS shock one SD stronger would have increased the growth in premature births between 2000 and 2010 in 25.9%[10]. It is important to see that for variables related with low weight and extremely premature births, when adding controls for healthcare initial conditions, IS effects and XD effects have point estimates with opposing signs, suggesting that, indeed, the prevailing pattern is that birth outcomes have a positive relation with the economic dynamism of a specific local market.

Although results for birth outcomes from this IV strategy have been more encouraging than using the FD specification, results for mortality are similar in both models. As we can see in both Tables 7 and 8, point estimates for the general mortality rate are close to the ones found in Tables 3 and 5 respectively; IS shocks raise mortality rates while XD reduces it. Table 7 shows very similar results to Table 3, with little variation in the size and statistical significance of effects: IS shocks increases mortality by infectious diseases and for unknown motives, but no significant effects are found anymore to malnutrition. On the other hand, XD does not seem to have any statistically significant impact, rather than a marginally significant and counter-intuitive positive impact in respiratory diseases. Considering the average micro-region, a one

[8] An increase of 3.81 grams divided by an average variation of -27.67 grams.
[9] That is, respectively: an impact of -0.075 p.p. divided by a variation of 0.776 p.p.; an impact of -0.029 p.p. divided by 0.307 p.p.; and an impact of -0.016 p.p. divided by 0.307 p.p.
[10] An increase of 0.029 p.p. divided by an average variation of 0.115 p.p.

SD increase in the competition shock would have reduced the fall of infant mortality caused by infectious diseases in 17.5% and the decline of infant mortality caused by unknown motives in 30.1% between 2000 and 2010[11].

Table 8 reaffirms the previous evidence with the FD Model that results for mortality are not very robust. For XD shocks, it is important to notice that the sum of the two statistically significant results (for respiratory diseases and for unknown causes) is still negative, although the increase for respiratory diseases is counter-intuitive with the general evidence previously outlined. One possibility is that the increase in respiratory diseases occurs because of better diagnosis due to better healthcare infrastructure, motivating part of the reduction in deaths by undetectable/unknown causes.

[11] Respectively, an increase of 0.175 death per 1,000 live births divided by a reduction of 1 death per 1,000 live births and an increase of 0.628 deaths per 1,000 live births divided by a decline of 2 deaths per 1,000 live births.

V. Mechanism for the XD and IS shocks

On the previous section of this paper, models estimated considered the reduced-form impacts of import and export shocks in Brazilian micro-regions' health outcomes. I now look at the possible mechanisms through which the competition and demand shock might have affected infant health outcomes. Since those were the more robust results of this paper, I focus here on how mechanisms affected the following variables: average weight and shares of low, very low and extremely low weight births and extremely premature births. In Tables 9 and 10, I consider the effects of the import and export shocks in maternal educational composition, maternal health-seeking activities and local labor market dynamics. While in Table 9, I use a model identical to the baseline, in Table 10, I also add control for the possibility that initial economic and healthcare conditions affect micro-regional trends.[12]

a. Maternal educational composition

In Panel A of both Tables, I consider maternal characteristics and it seems that the trade shocks might have indeed some effects on maternal educational composition. In general, negative income shocks looks to be closely associated with the increase in the share of total births belonging to lower educated mothers (those with no schooling), while results for positive shocks suggests some selection towards higher educated mothers (those with 12 or more years of study). These results can be associated both with different sensitivities of fertility to economic shocks between women of different educational levels; or it could be the result of changes in the general attainment of all women (not only mothers) caused by these shocks. Since I am only considering data from SINASC, it is not possible to make this distinction.

In Table 9, we notice that the IS shock has negative coefficients for the share of mother with four years or more of education, while mothers with no schooling at all and with 1 to 3 years of study rise, with these two latter coefficients being statistically significant. For this same table, the XD coefficients seems to show that the demand shock has made a "disruptive

[12] Before starting this section, it is important to emphasize that, although not reported on this paper, I also considered variables of healthcare infrastructure (hospitals, beds, physicians and facilities), immunization coverage of babies and some maternal characteristics such as age, race and number of children. Nonetheless, although these variables may be correlated with infant health outcomes, they have not shown any robust and consistent relation with the IS and XD shocks that this paper analyzes.

selection", a selection to the extremes, benefiting both the share of lowest educated mothers and the share of best-educated ones. Controlling for economic and healthcare initial conditions, in Table 10, the only robust coefficients are that the IS shocks increases the share of births with mothers with no schooling and that XD shocks increases the share of mother that have studied more than 12 years.

More years of education in Brazil are usually correlated with better health outcomes for mothers and definitely higher wage premiums for those who finish high-school and, more importantly, for those who complete a tertiary educational level, such as an undergraduate course. Hence, we should expect that better outcomes when it comes to maternal welfare should have been translated in one way or another on better outcomes for their newborns. Using the SINASC data for the year 2010, we estimate "Educational Premiums" by regressing a desired health outcome against educational level categories (omitting the no schooling category), controlling for state fixed effects. In figure 1, we show the results for this minor estimation exercise on five variables: the bars represents the premium for each educational category vs. no schooling.

The results do not show a strictly increasing behavior of good health in light of better education; safe for the share of low weight births. Results for the share of very low weight, extremely low weight and extremely premature births lack precision and do not show any strong correlation[13]. Nonetheless, it is possible to see that for both the average weight and for the low weight births, mothers with no schooling lag behind the other categories, especially the higher educated ones, with 8 to 11 years of schooling and with 12 or more years of schooling. Therefore, there is some suggestive evidence that the change in maternal educational composition may have been one of the mechanisms through which the "Chinese Boom" have affected birth outcomes: the demand shock increases the participation of higher educated women in total births, which in turn causes an improvement on the average birth outcomes. On the other hand, the competition shock increases that share of births belonging to lower educated mothers, which causes a deterioration on average outcomes.

[13] Part of educational level being positively correlated with poorer birth outcomes in extreme cases (such as births that are extremely premature and that have very low weight and extremely low weight) may be caused by reduced abortion levels in high-risk gestations for highly educated mothers. Or, in other words, the risk of fetal deaths in very delicate gestation processes are lower for higher educated

b. Health-seeking activities

In Table 9, Panel A, there is some suggestive evidence that negative economic shocks may have reduced the amount of antenatal visits while the positive shocks did not follow a clear pattern: there is some reduction in the share of newborns whose mothers have gone from four to six visits and increases in all other categories. Although not reported here, if we do the same exercise as seen in figure 1, there is a very clear correlation between the improvement in birth outcomes and an increase of antenatal visits. Therefore, at least considering the baseline specification, the IS shock may have contributed to the increase of extremely premature births through the mechanism of reduced antenatal visits. However, these results are not robust: when controlling for possible effects on health outcomes' trends of economic and healthcare initial conditions, both shocks favors the extreme sides of the spectrum.

c. Local labor market dynamics

Table 9 and 10 shows indeed, at least for point estimates direction, results similar to Costa, Garred and Pessoa (2016) in the case of labor market variables. Considering only point estimates, the IS shock resulted in reduced wages for most job categories, reduced share of skilled jobs, but higher employment shares. The XD shock resulted in higher wages for most job categories, higher employment shares (although of smaller magnitude when compared to the IS shock) and higher share of formal workers. Nonetheless, these results tend to be particularly sensible to controls for the initial economic conditions, which are part of these authors' baseline specification and which are not part of the baseline model of this paper. Hence, when adding controls for initial economic and healthcare conditions, in Table 10, coefficients for the IS shock tends to reduce and loose precision, while XD estimated effects are higher in absolute values or at least more precise for most variables.

Since there is no quality data on mothers' income and occupation in the SINASC database, it is not possible to make a similar exercise as the one provided in figure 1. Nonetheless, we can regress the birth outcome variable against the labor market variables with a FD model.[14] In Table 11, we can see the results of these regressions and what it is noticeable is that most of these previously mentioned variables do not seem to be robustly correlated with

[14] Before discussing the results of these regressions, estimated impacts of these variables with this simple FD model can be biased and, hence, these impacts are not considered as the causal effects in birth outcomes. The sole intention of these regressions is to have some suggestive evidence of how the labor market dynamics interacts with infant health.

birth outcomes. For the most part of independent variables, especially the ones weight-related, coefficients are not statistically different from zero in all specifications.

However, for the share of extremely premature births, the results seems to be largely suggestive that, indeed, competition shocks affect them through labor market dynamics. Considering statistically significant coefficients on Table 9, the shock caused by imports from China increases employment rates and the share of workers in unskilled activities, as well as reduces wages. This, in turn, contributes to the reduction of gestational length and a higher share of premature births. One possible intuition for this chain of effects is that increases in employment rate relates with reduced activities of mother when it comes to health-seeking activities, which can, in turn, expand the level of premature births. The rise in unskilled occupations may be due to the increase in the services sector against industries, which could therefore mean less physically demanding activities for women, contributing to reducing the number of extremely premature babies. Furthermore, the positive correlation between wages and health seem to indicate that lower salaries may have affected the capacity of women to pay for proper antenatal healthcare, which, in turn, could have caused the reduction in gestational length.

In summary, the evidence found in this section does not offer a clear picture of the mechanisms through which the "Chinese Boom" affected infant outcomes in Brazil. There are some robust results that higher exposure to XD shocks seems to contribute with changes in maternal composition in favor of higher educated mothers, while IS shocks may have increased the number of poor educated ones. This change in maternal composition may be part of the explanation for increases in birth weight and the reduction of low weight births and its varied categories. There is also some suggestive evidence that IS shocks may have contributed to poorer birth outcomes through the reduction of antenatal visits, which seems to be highly correlated with longer gestational lengths and higher birth weights. IS shocks may have also reduced the amount of extremely premature births through labor market dynamics. Results of this section are not definitive and it is still important to differentiate between male and female workers, in order to analyze how shocks affected maternal salaries, share of employment and level of participation.

VI. Discussion of results in light of the previous literature

The results found for this paper are in line with the majority of a growing literature about the impacts of economic shocks on infant health and birth outcomes in the context of developing countries. Nonetheless, there is a clear distinction between this papers' approach and the significant majority of this literature: the time length of the economic shock. Since this paper analyzes the effects of Chinese Booms with a FD Model comparing the year 2010 with 2000 and since the Chinese emergence in global markets has changed the landscape of Brazilian trade for many years to come, it is better to classify the economic shocks studied in this paper as permanent changes in local labor market economic structures. On the other hand, most papers that study the causality of economic shocks on health tends to focus on economic cycles

Even though those methodological differences are clear, this paper prevailing evidence is in line with the most part of literature of economic shocks and its impacts on health outcomes. In our preferred specification, there is robust evidence that positive economic shocks brought by the exports to China increases the average weight of newborns as well as it reduces the share of births with low weight. Similar evidence is in line with evidence brought by Bozzoli and Quintana-Domenque (2014) about the Argentinian crisis in the early 90s and its impacts on newborns weight. The evidence of this paper are also partially in line with the impacts of the Russian crisis in nutrition and health by Stillman and Thomas (2004). Nonetheless, these latter authors do not find evidences that permanent shocks have any impact on the weight to age of the young, while this is exactly what this papers' XD coefficients for weight-related variables represents for Brazilian newborns.

Surprisingly, when it comes to the competition shocks brought by the imports from China, the evidence that worsen economic conditions tend to shorten the gestational length is in line with evidence of developed countries, brought by the Wüst (2015). However, while this author considers stress as the main channel through which negative economic shocks increase premature births, its seems that the explanation for Brazil looks like as more multifaceted: lower wages, higher employment, less antenatal visits may play a role on the rise of premature births.

It is possible to argue that our evidence is also opposed to evidence brought by Dehejia and Lleras-Muney (2004), since these authors found that positive economic conditions worsens birth outcomes. However, there is an important distinction between their paper and this paper approach, they consider the employment rate and what these authors notice is that higher

employment rates are linked with worsening of health outcomes. What Table 11 suggests is that, indeed, at least considering for most of the point estimates, employment rates are positively correlated with poorer health (higher share of very low weight, extremely low weight and extremely premature births when controlling for initial conditions) and the IS shock seems to cause higher employment rates in local labor markets. Interestingly higher employment rates, especially for women, are seen as the reason why negative economic shocks increases infant mortality in rural India, as reported by Bhalotra (2010), and why the Coffee demand shocks in Colombia have caused rising mortality rates, according to Miller and Urdinola (2010). Although Cutler et al. (2002) do not elaborate on the issue; there is some evidence that the economic crisis in Mexico has raised the participation of women in the labor market, which could have been another potential way that the negative economic shock could have affected infant health. These authors, however, preferred to evaluate only the impact of this possible channel for old people only.

Specifically in the case of infant mortality, this paper does not offer the same level of robustness between the relation of economic shocks and infant mortality; nonetheless, the point estimates of the infant mortality rate are consistent with the prevailing evidence of the developing world. As seen in the literature review of Ferreira and Schady (2009) and by the study of DHS world data by Baird, Friedman and Schady (2011), economic recessions tends to be associated with higher infant mortality rates. Moreover, regarding mortality divided by the main causes of death, at least in baseline specifications for the FD and IV model, estimated impacts on mortality rates of IS shocks are higher and more precise than XD effects. This is also consistent with evidence of the latter paper cited as well as with Bhalotra (2010). Indeed, negative income shocks tend to have higher effect than positive shocks, even when they have the same absolute values.

This paper also adds new evidence when it comes to the effects of maternal composition. In opposition to Bhalotra (2010), as well as Dehejia, and Lleras-Muney (2004), negative economic shocks in Brazil has the impact of raising the share of births of mothers with no schooling. This is consistent with literature in some developed countries where higher economic uncertainty or even an economic crisis provide incentives for higher educated or more successful mothers to delay fertility (Perry, 2004).

Furthermore, changes in maternal composition may play an important in future outcomes of children, which means that the "Chinese Boom" may have long-term impacts on

local labor markets and on families' welfare. If a similar phenomenon to the one evidenced for East Germany by Chevalier and Marie (2015) occurs in Brazil, changes in maternal composition caused by the emergence of China in world trade will possibly have consequences for educational attainment of young Brazilians as well as on its future labor market outcomes. Additionally, there is also another more direct manner through which the IS and XD shock can affect local markets and individual wellbeing in the long run: a growing literature shows that good birth outcomes may have positive consequences for a child's future, while weak birth outcomes have dire consequences. As analyzed by Gutierrez (2017), the Peruvian economic crisis of the late 80's and early 90's has had not only negative short term consequences for children, but also long term consequences, reducing teenagers' educational attainment as well as its chances of ending primary education. The competition shock could have similar effects in Brazil, while the demand shock could create a virtuous cycle for the local labor markets most exposed by it.

As seen in this paper, there is robust evidence that the positive economic shock of demand brought by exports to China increased the average weight of micro-regions, while reducing the share of low weight births. This means that an important part of improvement in birth outcomes was concentrated on the most fragile fraction of births, the ones with poor weight measurements. This could very well have short and long run effects in Brazil. Nonetheless, economic literature on birth weights still struggles to find out if the relation seen in data between ones birth weight on its present or future outcomes is causal or spurious. Almond, Chay and Lee (2005) argue that cross-sectional estimates of birth weight effects are severely biased and, by comparing twin-pairs, they note that weight births effects on short-terms outcomes and hospital costs are much smaller than imagined. Even so, these authors acknowledge that these effects of birth weights are not linear, which means for very low weight births the impact of some more grams is far from negligible, at least in some health outcome variables.

Black, Devereux and Salvanes (2007) estimates the causal effects of birth weights in short and long-term using variation in birth weight between twins. Although these authors do find small short-term impacts in infant mortality and five minute Apgar score, like Almond, Chay and Lee (2005), they also find significant results for long-run results: such as higher earnings, higher IQ and education level. Intergenerational effects are also found: a persons' heavier birth weight causes higher birth weights to its first-born son. Since the demand shock

had impacts especially on those low weight newborns, it is possible to expect changes in present and future outcomes of these children in Brazil.

VII. Conclusion

This paper studies the relationship between economic shocks and infant health, by exploring the Chinese rise in global markets and its impacts in Brazilian local labor markets. The demand (positive) shock of Brazilian exports to China and the competition (negative) shock of Brazilian imports from China has had economically and statistically significant effects on infant health outcomes in Brazil. In this paper's preferred specification, robust results indicate that demand shocks from the "Chinese Boom" caused an increase in average newborn weight and a lower share of low, very low and extremely low weight births, while competition shocks from China caused a higher share of extremely premature births. There is some evidence that these shocks may have caused variations in infant mortality rate. Point estimates suggests that demand shocks reduced deaths of children under one-year old and competition shocks increased it. Supply shocks seems to cause an increase in deaths caused by malnutrition, infectious diseases and unknown causes, but these results are not robust when controlling for healthcare and economic conditions.

These economic shocks may have affected health outcomes through different mechanisms. One possible channel is maternal characteristics. Demand shocks seems to have caused changes in maternal composition in favor of higher educated mothers, increasing the share of higher educated women on total births, while the competition shock caused an increase in the share of mothers with lower education. An explanation for that could be found on different sensitivities of fertility between women with different levels of educational attainment. Higher-educated women could delay fertility in circumstances of economic hardship and crisis, while lower-educated ones do not have the same type of behavior, which, in turn, could cause a deterioration on the average births outcomes in the event of a competition shock. Another possible reason for this pattern of effects may be due to the impact of economic shocks on educational level of all women: a positive economic shock could have caused an increase of local educational services, which in turn could have increased the share of higher educated women, contributing to better infant health outcomes.

Furthermore, labor market changes may have been one mechanism through which shocks may have affected infant health: this may be the case especially for extremely premature births, where the competition shock increased employment growth and shrunk wage growth, which are both negatively correlated with the gestational length of women. However, this economic channel may not be as important for other health variables. These mechanisms

analysis need further investigations, especially because differential impacts between man and women outcomes were not studied. Women labor participation, its wages and its share of employment may be more important than general workforce averages to explain possible impacts in birth outcomes, which are particularly sensible to maternal life-style during gestation.

Therefore, this paper provides important contributions to literature that seeks to investigate the relationship between economic shocks and infant health. Nonetheless, different from the established literature on this area, which tends to analyze economic fluctuations and cycles, this paper focuses on a trade shock with persistent consequences in labor markets, which means that these results could be interpreted as the impact of permanent economic variations on infant health outcomes. This seems to be a limitation of this paper methodological design, but it is also a window of opportunity for further studies on the short-term relationship between aggregate economic shocks and infant mortality and health. This could be done using aggregate GDP fluctuations on municipal or state level or by constructing the same XD and IS variable for many more years.

From a public policy perspective, this paper sheds light also on one of the other many possible consequences that trade shocks may have in welfare. As already seen in previous literature considering trade shocks in Brazil and across the world, changes in trade patterns between countries may have consequences in crime, gender and racial discrimination and even politics. Therefore, Brazilian policy-makers must be cautious of the possible consequences of the Chinese trade shocks in local realities. While the increase in weight and the reduction of low weight births may create a virtuous cycle in local labor markets more exposed to the demand shocks, the rise in extremely premature births may bring consequences not only in the short run, but also in the long run of regions most exposed to the competition shocks. Studying this long run effects will be extremely important in order to consider the full dimension of the effects of trade with China on Brazilian general welfare.

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IX. Appendix

Table 1: Descriptive Statistics at the Micro-region Level (Initial Conditions - 2000)

Variable	Source	All Microregions		IS (Top Quantile)		XD (Top Quantile)		top IS vs All		top XD vs All	
		Mean	SD	Mean	SD	Mean	SD	Mean Diff.	p-value*	Mean Diff	p-value*
	(0)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Infant Health											
Live Births	Datasus/SINASC	7,778.9	19,664.0	17,490.6	39,098.1	8,484.0	20,705.5	9,711.6	3.0%	705.1	77.6%
Birth Rate	Datasus/SINASC	18.39	3.40	17.51	2.28	18.23	2.84	-0.87	0.4%	-0.16	66.0%
APGAR 1	Datasus/SINASC	8.01	0.59	8.20	0.26	8.14	0.44	0.19	0.0%	0.12	3.0%
APGAR 5	Datasus/SINASC	9.08	0.70	9.29	0.25	9.22	0.46	0.21	0.0%	0.14	2.1%
Weight (grams)	Datasus/SINASC	3,230.7	75.3	3,171.9	54.0	3,208.3	70.8	-58.8	0.0%	-22.4	1.0%
Low Weight Births (as % of total births)	Datasus/SINASC	6.98	1.52	8.19	1.23	7.36	1.48	1.21	0.0%	0.38	3.4%
Premature Births (as % of total births)	Datasus/SINASC	6.56	3.30	6.80	1.93	6.86	4.32	0.24	36.9%	0.31	53.9%
Healthcare Infrastructure											
Hospitals (*per* 1,000)	Datasus	0.06	0.04	0.04	0.02	0.06	0.04	-0.02	0.0%	0.01	20.9%
Hospital Beds (*per* 1,000)	Datasus	2.88	1.88	3.22	1.85	2.92	1.23	0.35	12.2%	0.04	79.6%
Health Facilities (*per* 1,000)	PAMS 2002	0.49	0.16	0.46	0.17	0.52	0.15	-0.03	9.5%	0.03	11.4%
High-Skilled Health Professionals (per 1,000)	PAMS 2002	3.11	1.73	4.69	1.53	3.26	1.40	1.58	0.0%	0.15	40.5%
Sewage Access (% of Population)	Census 2000	33.74	30.01	62.45	27.33	35.88	28.37	28.70	0.0%	2.14	53.7%
Vaccination Coverage (Children under 1 year old)											
BCG (%)	Datasus/PNI	111.69	39.49	111.70	32.59	114.44	22.50	0.01	99.8%	2.76	38.1%
Hepatitis B (%)	Datasus/PNI	96.80	25.08	104.24	35.38	100.97	18.71	7.44	7.1%	4.17	8.4%
Polio (%)	Datasus/PNI	105.13	22.90	107.17	28.42	109.31	16.58	2.04	54.1%	4.19	5.2%
Measles (%)	Datasus/PNI	108.42	24.05	109.37	28.63	113.32	16.99	0.94	77.9%	4.90	2.8%
DTP (%)	Datasus/PNI	99.90	21.07	105.35	28.81	104.25	14.66	5.45	10.5%	4.35	2.5%
Hib (%)	Datasus/PNI	89.69	35.72	107.59	37.40	93.94	33.97	17.89	0.0%	4.25	30.5%
Federal Gov. Programs											
Family Health Program (% of target population)	DAB	25.96	21.05	17.63	18.26	23.17	16.92	-8.32	0.0%	-2.78	19.3%
Community Health Agent (% of target population)	DAB	58.75	32.61	28.20	26.56	49.74	25.42	-30.55	0.0%	-9.02	0.6%
Mother Attributes											
Single Mothers (%)	Datasus/SINASC	50.47	13.36	47.56	9.98	50.77	11.83	-2.91	2.4%	0.30	83.5%
Age	Datasus/SINASC	24.44	0.94	25.06	0.65	24.38	1.01	0.62	0.0%	-0.06	60.5%
Minor Moms (%)	Datasus/SINASC	11.89	2.83	9.70	1.81	11.72	2.67	-2.19	0.0%	-0.17	59.1%
% with No Schooling	Datasus/SINASC	7.25	7.32	1.99	1.48	3.98	3.58	-5.26	0.0%	-3.27	0.0%
% with Very High Schooling	Datasus/SINASC	8.98	4.66	12.65	3.55	10.59	4.23	3.67	0.0%	1.62	0.2%
Number of Live Children	Datasus/SINASC	1.50	0.49	1.14	0.20	1.34	0.37	-0.36	0.0%	-0.16	0.1%
Number of Dead Children	Datasus/SINASC	0.19	0.14	0.12	0.07	0.17	0.12	-0.07	0.0%	-0.02	19.1%
Child and Birth Characteristcs											
Male (%)	Datasus/SINASC	51.33	1.21	51.34	0.98	51.26	1.12	0.01	91.9%	-0.08	58.1%
Black or Brown (%)	Datasus/SINASC	41.17	27.73	21.96	21.91	37.70	27.12	-19.22	0.0%	-3.47	29.1%
Natural Birth (%)	Datasus/SINASC	65.44	15.50	53.08	10.12	61.27	13.43	-12.36	0.0%	-4.17	1.3%

*p-value for Welch Two-Sample t-test

Notes: *Column (0) offers the source of each variable available. Columns (1), (3) and (5) provides respectively the sample mean of 30 variables for the whole sample (412 micro-regions), for the micro-regions on the top quintile of the distribution of Import Supply (IS) Shocks (n = 83) and on the distribution of Export Demand (XD) Shocks (n = 83). This set of variables includes data on birth outcomes, health infrastructure and availability of particular federal programs, as well as information on mother and child attributes. Columns (2), (4) and (6) shows the standard deviations of each of these variables. Columns (7) and (9) offers the mean differences between the whole sample and the restricted samples – IS and XD respectively – while Column (8) and (9) offers the p-value for two-sided Welch t test.*

Table 2: Impacts of economic shocks on health outcomes (FD Model)

	(1)	(2)	(3)	(4)
Panel A: Weight Variables	Average Weight	% of Low Weight Births (< 2500 g)	% of Very Low Weight Births (< 1500 g)	% of Extremely Low Weight Births (< 1000 g)
Import Supply Shock (IS)	10.391	-0.113	0.037	0.048
	(7.104)	(0.171)	(0.049)	(0.030)
Export Demand Shock (XD)	5.427**	-0.110	-0.048***	-0.015
	(2.693)	(0.070)	(0.013)	(0.011)
Variable Variation (2000 - 10)	-27.694	0.776	0.307	0.203
R2	0.554	0.252	0.257	0.289
Panel B: Gestational Length Variables	% of Premature Births (Less than 37 weeks)	% of Moderately Premature Births (32 to 36 weeks)	% of Very Premature Births (28 to 31 weeks)	% of Extremely Premature Births (Less than 28 weeks)
Import Supply Shock (IS)	0.307	0.192	0.043	0.072***
	(0.525)	(0.511)	(0.047)	(0.023)
Export Demand Shock (XD)	0.008	0.025	-0.021	0.004
	(0.305)	(0.291)	(0.016)	(0.014)
Variable Variation (2000 - 10)	0.452	0.323	0.015	0.115
R2	0.280	0.270	0.208	0.185
Panel C: APGAR Variables	Average APGAR 1 (Apgar score in the 1st minute)	% of Births with Low Apgar 1 (below 8)	Average APGAR 5 (Apgar score in the 5th minute)	% of Births with Low Apgar 5 (below 8)
Import Supply Shock (IS)	-0.023	1.693***	-0.050	0.831***
	(0.039)	(0.622)	(0.034)	(0.312)
Export Demand Shock (XD)	-0.042	1.023**	-0.070	0.688
	(0.039)	(0.487)	(0.053)	(0.518)
Variable Variation (2000 - 10)	0.227	-2.602	0.216	-1.626
R2	0.283	0.353	0.324	0.336
Observations	412	412	412	412
Constant	YES	YES	YES	YES
State Trends	YES	YES	YES	YES

*Notes: This table shows the impact of Chinese import supply shocks and export demand shocks on Brazilian micro-regions' health outcomes. The results come from a First Difference model. In all regressions, I include controls for State specific trends and a constant. All results are weighted by share of national live births in 2000. Robust standard errors in parentheses adjusted by meso-regional clusters. *** p<0.01, ** p<0.05, * p<0.1. Sources: Datasus and Costa, Garred and Pessoa (2016) dataset.*

Table 3: Impact of economic shocks on infant mortality rates (FD Model)

	Infant Mortality	Infant Infectious	Infant Malnutrition	Infant Respiratory	Infant Perinatal	Infant Congenital	Infant Unknown	Infant External
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Import Supply Shock (IS)	1.350	0.458***	0.106*	-0.125	-0.446	0.029	1.390**	0.036
	(1.158)	(0.160)	(0.061)	(0.147)	(0.813)	(0.164)	(0.648)	(0.051)
Export Demand Shock (XD)	-0.369	0.045	0.017	0.090*	-0.649*	-0.082	0.266*	-0.006
	(0.364)	(0.071)	(0.032)	(0.054)	(0.330)	(0.075)	(0.151)	(0.018)
Observations	412	412	412	412	412	412	412	412
Variable Variation (2000 - 10)	-7.365	-1.002	-0.337	-0.810	-3.140	0.285	-2.088	-0.030
R2	0.363	0.394	0.253	0.132	0.221	0.346	0.456	0.316
Constant	YES	YES	YES	YES	YES	YES	YES	YES
State Trends	YES	YES	YES	YES	YES	YES	YES	YES

*Notes: This table shows the impact of Chinese import supply shocks and export demand shocks on Brazilian micro-regions' infant mortality rates. The results come from a First Difference model. In all regressions, I include controls for State specific trends and a constant. All results are weighted by share of national live births in 2000. Robust standard errors in parentheses adjusted by meso-regional clusters. *** p<0.01, ** p<0.05, * p<0.1. Sources: Datasus and Costa, Garred and Pessoa (2016) dataset.*

Table 4: Health outcomes - robustness tests (FD Model)

	Average Weight			% of Very Low Weight Births (< 1500 g)			% of Extremely Premature Births (Less than 28 weeks)			% of Births with Low Apgar 1 (below 8)			% of Births with Low Apgar 5 (below 8)		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
Import Supply Shock (IS)	10.391	-4.997	3.657	0.037	0.078	0.061	0.072***	0.047*	0.040	1.693***	0.887	0.469	0.831***	0.289	-0.272
	(7.104)	(5.993)	(7.940)	(0.049)	(0.052)	(0.066)	(0.023)	(0.025)	(0.028)	(0.622)	(0.640)	(0.693)	(0.312)	(0.439)	(0.706)
Export Demand Shock (XD)	5.427**	2.975	3.735	-0.048***	-0.038***	-0.032**	0.004	0.000	-0.007	1.023**	0.590**	0.172	0.688	0.458	0.368
	(2.693)	(2.015)	(2.249)	(0.013)	(0.014)	(0.015)	(0.014)	(0.015)	(0.013)	(0.487)	(0.248)	(0.288)	(0.518)	(0.323)	(0.293)
Observations	412	412	412	412	412	412	412	412	412	412	412	412	412	412	412
Variable Variation (2000 - 10)	-27.694	-27.694	-27.694	0.307	0.307	0.307	0.115	0.115	0.115	-2.602	-2.602	-2.602	-1.626	-1.626	-1.626
R2	0.554	0.643	0.657	0.257	0.320	0.330	0.185	0.232	0.269	0.353	0.413	0.444	0.336	0.378	0.389
Constant & State Trends	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Healthcare Conditions		YES	YES		YES	YES		YES	YES		YES	YES		YES	YES
Economic Conditions			YES			YES			YES			YES			YES

*Notes: This table shows the impact of Chinese import supply shocks and export demand shocks on Brazilian micro-regions' heath outcomes. The results come from a First Difference model. In columns (1), (4), (7), (10) and (13), I include controls for State specific trends. In columns (2), (5), (8), (11) and (14), controls for healthcare initial conditions in 2000 are added: total population, number of physicians, of health facilities, of hospitals and of hospital beds per 1,000 people; vaccination coverage (BCG, Hepatitis B, Polio, MMR, DTP); sewage coverage and coverage of community programs PSF and ACS. In columns (3), (6), (9), (12) and (15), I also add economic initial conditions in 2000: workforce, share of workforce in agricultural sectors, share of workforce in extractive sectors, share of workforce in manufacturing, share of workforce in informal jobs, share of workforce in rural areas, and a cubic polynomial of income per capita in 2000. All results are weighted by share of national live births in 2000 and all results include a constant. Robust standard errors in parentheses adjusted by meso-regional clusters. *** p<0.01, ** p<0.05, * p<0.1. Sources: Brazilian Census 2000, Datasus, PAMS 2002, and Costa, Garred and Pessoa (2016) dataset.*

Table 5: Infant mortality rates - robustness tests (FD Model)

	Infant Mortality (1)	Infant Infectious (2)	Infant Malnutrition (3)	Infant Respiratory (4)	Infant Perinatal (5)	Infant Congenital (6)	Infant Unknown (7)	Infant External (8)
Import Supply Shock (IS)	1.457	0.328*	0.196***	-0.073	0.556	0.333*	0.324	0.050
	(1.109)	(0.196)	(0.068)	(0.150)	(0.458)	(0.177)	(0.574)	(0.061)
Export Demand Shock (XD)	-0.188	-0.020	0.002	0.122*	0.016	0.095	-0.346*	-0.016
	(0.408)	(0.088)	(0.039)	(0.062)	(0.354)	(0.081)	(0.178)	(0.022)
Observations	412	412	412	412	412	412	412	412
Variable Variation (2000 - 10)	-7.365	-1.002	-0.337	-0.810	-3.140	0.285	-2.088	-0.030
R2	0.518	0.503	0.400	0.286	0.459	0.431	0.714	0.361
Constant	YES	YES	YES	YES	YES	YES	YES	YES
State Trends	YES	YES	YES	YES	YES	YES	YES	YES
Economic & Health Conditions	YES	YES	YES	YES	YES	YES	YES	YES

*Notes: This table shows the impact of Chinese import supply shocks and export demand shocks on Brazilian micro-regions' heath outcomes. The results come from a First Difference model. In all regressions, I include controls for State specific trends and a constant. Moreover, controls for healthcare initial conditions in 2000 are added: total population, number of physicians, of health facilities, of hospitals and of hospital beds per 1,000 people; vaccination coverage (BCG, Hepatitis B, Polio, MMR, DTP); sewage coverage and coverage of community programs PSF and ACS. I also add economic initial conditions in 2000: workforce, share of workforce in agricultural sectors, share of workforce in extractive sectors, share of workforce in manufacturing, share of workforce in informal jobs, share of workforce in rural areas, and a cubic polynomial of income per capita in 2000. All results are weighted by share of national live births in 2000. Robust standard errors in parentheses adjusted by meso-regional clusters. *** p<0.01, ** p<0.05, * p<0.1. Sources: Brazilian Census 2000, Datasus, PAMS 2002, and Costa, Garred and Pessoa (2016) dataset.*

Table 6: Impacts of economic shocks on health outcomes (IV Model)

	Average Weight			% of Low Weight Births (< 2500 g)			% of Very Low Weight Births (< 1500 g)			% of Extreme Low Weight Births (< 1000 g)			% of Extremely Premature Births (Less than 28 weeks)		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
Import Supply Shock (IS)	13.221	-3.251	5.674	-0.129	0.181	0.055	0.054	0.105**	0.099	0.060*	0.069**	0.057	0.085***	0.071***	0.069**
	(8.322)	(6.680)	(8.948)	(0.180)	(0.146)	(0.183)	(0.048)	(0.049)	(0.062)	(0.031)	(0.031)	(0.037)	(0.026)	(0.023)	(0.030)
Export Demand Shock (XD)	6.684**	4.844**	5.750***	-0.132*	-0.103*	-0.113**	-0.060***	-0.048***	-0.044***	-0.024**	-0.023*	-0.025**	-0.002	-0.003	-0.009
	(2.901)	(1.888)	(1.925)	(0.078)	(0.054)	(0.054)	(0.013)	(0.015)	(0.016)	(0.011)	(0.013)	(0.013)	(0.015)	(0.016)	(0.014)
Observations	412	412	412	412	412	412	412	412	412	412	412	412	412	412	412
Variable Variation (2000 - 10)	-27.694	-27.694	-27.694	0.776	0.776	0.776	0.307	0.307	0.307	0.203	0.203	0.203	0.115	0.115	0.115
R2	0.553	0.642	0.656	0.251	0.362	0.373	0.256	0.319	0.329	0.287	0.335	0.346	0.184	0.230	0.267
Constant & State Trends	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Healthcare Conditions		YES	YES		YES	YES		YES	YES		YES	YES		YES	YES
Economic Conditions			YES			YES			YES			YES			YES

*Notes: This table shows the impact of Chinese import supply shocks and export demand shocks on Brazilian micro-regions' heath outcome variables. The results come from an Instrumental Variable specification. In columns (1), (4), (7), (10) and (13), I include controls for State specific trends. In columns (2), (5), (8), (11) and (14), controls for healthcare initial conditions in 2000 are added: total population, number of physicians, of health facilities, of hospitals and of hospital beds per 1,000 people; vaccination coverage (BCG, Hepatitis B, Polio, MMR, DTP); sewage coverage and coverage of community programs PSF and ACS. In columns (3), (6), (9), (12) and (15), I also add economic initial conditions in 2000: workforce, share of workforce in agricultural sectors, share of workforce in extractive sectors, share of workforce in manufacturing, share of workforce in informal jobs, share of workforce in rural areas, and a cubic polynomial of income per capita in 2000. All results are weighted by share of national live births in 2000 and all results include a constant. Robust standard errors in parentheses adjusted by meso-regional clusters. *** p<0.01, ** p<0.05, * p<0.1. Sources: Brazilian Census 2000, Datasus, PAMS 2002, and Costa, Garred and Pessoa (2016) dataset.*

Table 7: Impact of economic shocks on infant mortality rates (IV Model)

	Infant Mortality (1)	Infant Infectious (2)	Infant Malnutrition (3)	Infant Respiratory (4)	Infant Perinatal (5)	Infant Congenital (6)	Infant Unknown (7)	Infant External (8)
Import Supply Shock (IS)	1.100	0.405***	0.094	-0.209	-0.611	0.046	1.452**	0.033
	(1.140)	(0.140)	(0.062)	(0.167)	(0.864)	(0.149)	(0.731)	(0.056)
Export Demand Shock (XD)	-0.359	0.022	0.038	0.104*	-0.515	-0.106	0.163	-0.013
	(0.385)	(0.067)	(0.032)	(0.061)	(0.409)	(0.070)	(0.226)	(0.017)
Observations	412	412	412	412	412	412	412	412
Variable Variation (2000 - 10)	-7.365	-1.002	-0.337	-0.810	-3.140	0.285	-2.088	-0.030
R2	0.363	0.393	0.252	0.131	0.221	0.346	0.455	0.316
Constant	YES	YES	YES	YES	YES	YES	YES	YES
State Trends	YES	YES	YES	YES	YES	YES	YES	YES

*Notes: This table shows the impact of Chinese import supply shocks and export demand shocks on Brazilian micro-regions' infant mortality rate. The results come from an Instrumental Variable specification. In all regressions, I include controls for State specific trends and a constant. All results are weighted by share of national live births in 2000. Robust standard errors in parentheses adjusted by meso-regional clusters. *** p<0.01, ** p<0.05, * p<0.1. Sources: Datasus and Costa, Garred and Pessoa (2016) dataset.*

Table 8: Infant mortality rates - robustness tests (IV Model)

	Infant Mortality (1)	Infant Infectious (2)	Infant Malnutrition (3)	Infant Respiratory (4)	Infant Perinatal (5)	Infant Congenital (6)	Infant Unknown (7)	Infant External (8)
Import Supply Shock (IS)	0.785	0.204	0.144*	-0.200	0.135	0.273	0.475	0.032
	(1.126)	(0.186)	(0.081)	(0.206)	(0.495)	(0.168)	(0.588)	(0.061)
Export Demand Shock (XD)	-0.348	-0.063	0.022	0.154***	0.025	0.038	-0.445**	-0.031
	(0.362)	(0.079)	(0.035)	(0.059)	(0.342)	(0.074)	(0.220)	(0.023)
Observations	412	412	412	412	412	412	412	412
Variable Variation (2000 - 10)	-7.365	-1.002	-0.337	-0.810	-3.140	0.285	-2.088	-0.030
R2	0.517	0.502	0.399	0.285	0.458	0.430	0.714	0.360
Constant	YES	YES	YES	YES	YES	YES	YES	YES
State Trends	YES	YES	YES	YES	YES	YES	YES	YES

*Notes: This table shows the impact of Chinese import supply shocks and export demand shocks on Brazilian micro-regions' infant mortality rates. The results come from an Instrumental Variable specification. In all regressions, I include control for State specific trends and a constant. Moreover, controls for healthcare initial conditions in 2000 are added: total population, number of physicians, of health facilities, of hospitals and of hospital beds per 1,000 people; vaccination coverage (BCG, Hepatitis B, Polio, MMR, DTP); sewage coverage and coverage of community programs PSF and ACS. I also add economic initial conditions in 2000: workforce, share of workforce in agricultural sectors, share of workforce in extractive sectors, share of workforce in manufacturing, share of workforce in informal jobs, share of workforce in rural areas, and a cubic polynomial of income per capita in 2000. All results are weighted by share of national live births in 2000. Robust standard errors in parentheses adjusted by meso-regional clusters. *** p<0.01, ** p<0.05, * p<0.1. Sources: Brazilian Census 2000, Datasus, PAMS 2002, and Costa, Garred and Pessoa (2016) dataset.*

Table 9: Maternal composition and channels

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Panel A: Maternal Composition	Mother's Education					Health-seeking Activity: Antenatal Visitis			
	% Non-Attendant	% with 1 to 3 years	% with 4 to 7 years	% with 8 to 11 years	% with 12 or plus	% None	% 1 to 3 visits	% 4 to 6 visits	% 7 or more
Import Supply (IS)	2.382***	6.065***	-5.897**	-2.480	-0.070	1.422**	3.084**	-0.745	-3.760
	(0.727)	(1.595)	(2.640)	(1.639)	(0.640)	(0.661)	(1.241)	(2.125)	(2.649)
Export Demand (XD)	0.610*	0.615	-1.865**	0.197	0.442*	0.380**	0.522	-1.826**	0.924
	(0.336)	(0.664)	(0.733)	(0.502)	(0.243)	(0.189)	(0.444)	(0.891)	(0.728)
Observation	412	412	412	412	412	412	412	412	412
R2	0.610	0.551	0.588	0.445	0.320	0.624	0.329	0.587	0.354
Panel B: Labor Market	Emplyment Share	Log Average Hourly Wages	Share of workers in a skilled occupation	Share of workers in a formal job	Hourly Wage (Formal)	Hourly Wage (Not Formal)	Hourly Wage (Skilled Workers)	Hourly Wage (Unskilled Worlers)	
Import Supply (IS)	5.506***	-0.054***	-1.541*	-0.970	-0.068***	-0.089***	-0.026	-0.049**	
	(1.313)	(0.017)	(0.796)	(0.857)	(0.018)	(0.028)	(0.016)	(0.020)	
Export Demand (XD)	1.626*	0.004	-0.427	0.539***	0.004	0.003	0.011	0.006	
	(0.897)	(0.012)	(0.372)	(0.207)	(0.006)	(0.019)	(0.009)	(0.010)	
Observation	412	412	412	412	412	412	412	412	
R2	0.567	0.726	0.451	0.340	0.551	0.609	0.581	0.638	

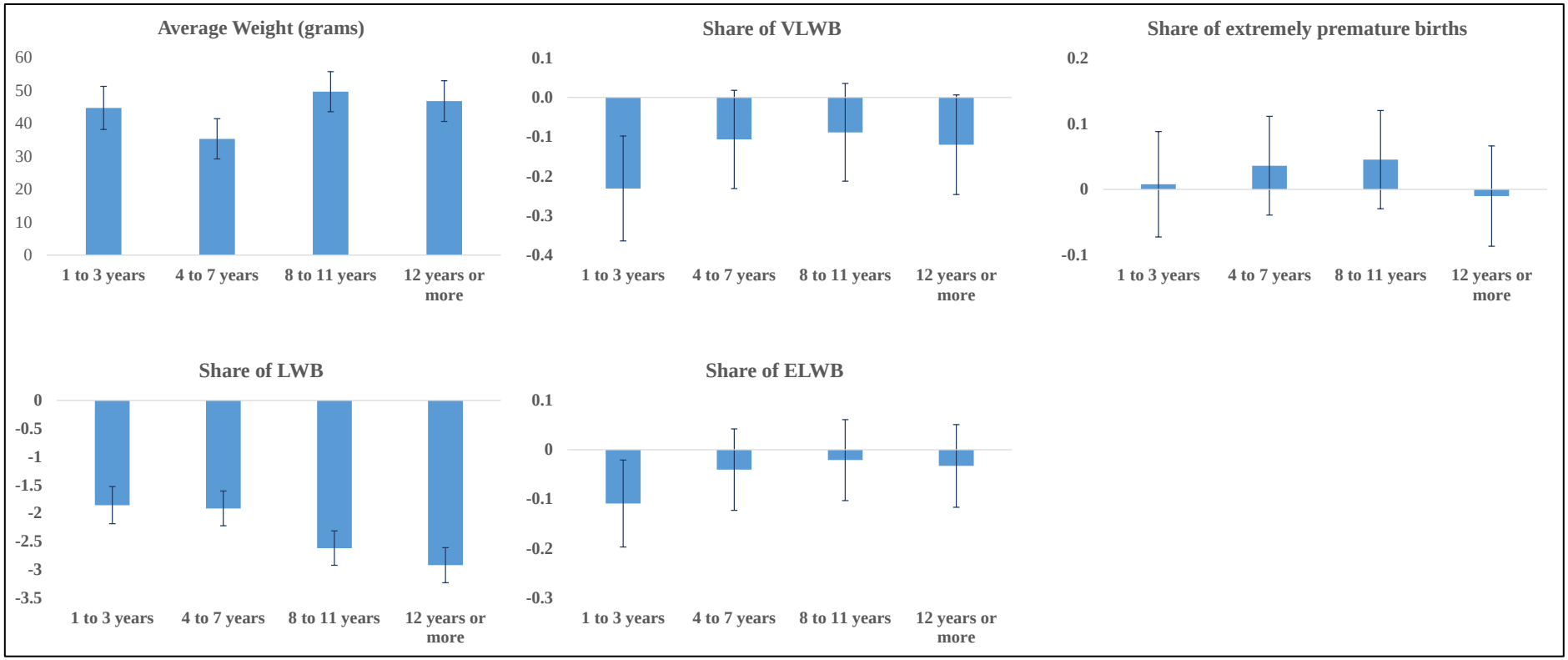
*Notes: This table shows the impact of Chinese import supply shocks and export demand shocks on maternal composition and labor market characteristics. The results come from an Instrumental Variable model. In all regressions, I include controls for State specific trends and a constant. All results are weighted by share of national live births in 2000. Robust standard errors in parentheses adjusted by meso-regional clusters. *** p<0.01, ** p<0.05, * p<0.1. Sources: Datasus and Costa, Garred and Pessoa (2016) dataset.*

Table 10: Maternal composition and channels (robustness)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Panel A: Maternal Characteristics	Mother's Education					Health-seeking Activity: Antenatal Visitis			
	% with no schooling	% with 1 to 3 years	% with 4 to 7 years	% with 8 to 11 years	% with 12 or plus	% None	% 1 to 3 visits	% 4 to 6 visits	% 7 or more
Import Supply (IS)	0.948***	1.523	-0.453	-1.743	-0.274	1.436**	-1.195*	-4.692**	4.451**
	(0.266)	(0.935)	(1.618)	(2.133)	(0.867)	(0.593)	(0.621)	(1.961)	(1.900)
Export Demand (XD)	0.012	-0.202	-0.189	-0.238	0.617**	0.311*	-0.304	-1.945**	1.937**
	(0.167)	(0.313)	(0.316)	(0.291)	(0.243)	(0.186)	(0.238)	(0.871)	(0.915)
Observation	412	412	412	412	412	412	412	412	412
R2	0.861	0.821	0.879	0.646	0.518	0.732	0.667	0.664	0.596
Panel D: Labor Market	Emplyment Share	Log Average Hourly Wages	Share of workers in a skilled occupation	Share of workers in a formal job	Hourly Wage (Formal)	Hourly Wage (Not Formal)	Hourly Wage (Skilled Workers)	Hourly Wage (Unskilled Worlers)	
Import Supply (IS)	1.016**	0.000	-1.058*	0.614	-0.024	-0.015	-0.006	0.007	
	(0.458)	(0.015)	(0.574)	(1.106)	(0.016)	(0.028)	(0.022)	(0.016)	
Export Demand (XD)	0.227**	0.011**	-0.096	0.446**	0.007	0.020*	0.019***	0.004	
	(0.111)	(0.005)	(0.144)	(0.210)	(0.005)	(0.010)	(0.006)	(0.006)	
Observation	412	412	412	412	412	412	412	412	
R2	0.924	0.848	0.722	0.516	0.738	0.813	0.681	0.777	

*Notes: This table shows the impact of Chinese import supply shocks and export demand shocks on maternal composition and labor market characteristics. The results come from an Instrumental Variable specification. In all regressions, I include control for State specific trends and a constant. Moreover, controls for healthcare initial conditions in 2000 are added: total population, number of physicians, of health facilities, of hospitals and of hospital beds per 1,000 people; vaccination coverage (BCG, Hepatitis B, Polio, MMR, DTP); sewage coverage and coverage of community programs PSF and ACS. I also add economic initial conditions in 2000: workforce, share of workforce in agricultural sectors, share of workforce in extractive sectors, share of workforce in manufacturing, share of workforce in informal jobs, share of workforce in rural areas, and a cubic polynomial of income per capita in 2000. All results are weighted by share of national live births in 2000. Robust standard errors in parentheses adjusted by meso-regional clusters. *** p<0.01, ** p<0.05, * p<0.1. Sources: Brazilian Census 2000, Datasus, PAMS 2002, and Costa, Garred and Pessoa (2016) dataset.*

Figure 1: "Education premium" on birth outcomes (2010 SINASC Sample)



Notes: The estimates of these figures are the result of running the variables above against education categories of mothers, controlling for state fixed effects. Sources: SINASC 2010/Datasus.

Table 11: Impacts of local labor market dynamics on health outcomes

	Average Weight			% of Low Weight Births			% of Very Low Weight Births			% of Extreme Low Weight			% of Extremely Premature		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
Emplyment Share	1.004	-0.925	-1.133	-0.010	0.019	0.023	0.001	0.005	0.012*	0.003	0.002	0.002	0.005**	0.005*	0.007
	(0.664)	(0.666)	(0.845)	(0.014)	(0.015)	(0.022)	(0.003)	(0.005)	(0.007)	(0.002)	(0.003)	(0.004)	(0.002)	(0.003)	(0.004)
Log Average Hourly Wages	-17.317	-15.339	-34.355	0.576	0.719	0.848	-0.145	-0.158	-0.063	-0.074	-0.073	-0.051	-0.309**	-0.273**	-0.247*
	(25.168)	(27.666)	(30.992)	(0.560)	(0.571)	(0.667)	(0.209)	(0.219)	(0.244)	(0.129)	(0.140)	(0.148)	(0.131)	(0.134)	(0.145)
Share of workers in a formal job	-0.374	0.180	0.234	0.017	0.003	0.006	0.000	-0.004	-0.004	-0.002	-0.003	-0.002	-0.002	-0.002	-0.001
	(0.512)	(0.503)	(0.616)	(0.015)	(0.015)	(0.017)	(0.004)	(0.005)	(0.005)	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)	(0.004)
Share of workers in a uskilled occupation	1.853*	1.162	0.727	-0.061**	-0.045	-0.038	-0.021***	-0.015**	-0.016**	-0.016***	-0.014***	-0.015**	-0.012***	-0.011**	-0.012**
	(1.022)	(1.077)	(1.211)	(0.027)	(0.028)	(0.031)	(0.005)	(0.007)	(0.007)	(0.005)	(0.005)	(0.006)	(0.004)	(0.005)	(0.006)
Observations	412	412	412	412	412	412	412	412	412	412	412	412	412	412	412
Variable Variation (2000 - 10)	-27.694	-27.694	-27.694	0.776	0.776	0.776	0.307	0.307	0.307	0.203	0.203	0.203	0.115	0.115	0.115
R2	0.583	0.644	0.658	0.294	0.367	0.380	0.261	0.317	0.335	0.298	0.343	0.357	0.209	0.252	0.284
Constant & State Trends	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Healthcare Conditions		YES	YES		YES	YES		YES	YES		YES	YES		YES	YES
Economic Conditions			YES			YES			YES			YES			YES

*Notes: This table shows the impact of labor market dynamics on health outcomes. The results come from aFirst Differences model. In all regressions, I include controls for State specific trends and a constant. All results are weighted by share of national live births in 2000. Robust standard errors in parentheses adjusted by meso-regional clusters. *** p<0.01, ** p<0.05, * p<0.1. Sources: Datasus and Costa, Garred and Pessoa (2016) dataset.*