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DOCUMENTO de TRABAJO

524

2019

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Francisco Gallego y Jeanne Lafortune.

www.economia.puc.cl · ISSN (edición impresa) 0716-7334 · ISSN (edición electrónica) 0717-7593

Baby Commodity-Booms?: The Impact of Commodity Shocks on Fertility Decisions and Outcomes*

Francisco Gallego† Jeanne Lafortune‡

September 2019

Abstract

This paper uses international commodity prices and local natural resources endowments as a source of plausibly exogenous variation in local economic conditions to study how these shocks impact fertility behavior of families in a small, emerging, open economy where non-marital fertility was common but parental obligations not well enforced. We find that these commodity shocks lead to an improvement in local economic conditions and an increase in the log number of births and the birth rate, as previous studies have demonstrated. However, more interestingly, we find that economic conditions do not seem to influence the decision to start a family but rather to expand it since only higher-order births are pro-cyclical. Furthermore, we find evidence that fewer single women conceive babies in periods of booms and that their partner is more likely to be employed and have a higher earning occupation, suggesting that booms influence not just fertility but family formation overall. We find limited evidence that babies conceived in periods of booms have worse health outcomes, as compared to the existing literature, maybe because better family formation counteract the births of more marginal children.

*Fernanda Rojas provided excellent research assistance. We also benefited from work by Maria Paz Irarrazaval for her Master's thesis written at EH Clio Lab. We would like to thank seminar participants at the 2017 SECHI meetings and the EH Clio Lab 2018 conference for comments and suggestions. We would like to thank FONDECYT (Project 1170956) for financial support. All replication files can be found at: https://github.com/fagallego/babycommoditybooms. All errors are our own. Corresponding author: Jeanne Lafortune, E-mail: jlafortune@uc.cl.

†Pontificia Universidad Catolica de Chile.

‡Pontificia Universidad Catolica de Chile.

1 Introduction

How do income shocks alter decisions related to fertility and family formation? Many previous studies have documented that birth rates are pro-cyclical suggesting a positive relationship between income and births (from Ben-Porath, 1973; Galbraith and Thomas, 1941; Silver, 1965 to the more recent work of Black, Kolesnikova, Sanders, and Taylor, 2013; Lovenheim and Mumford, 2013). The impact of economic prosperity on fertility decisions is theoretically complex. The impact of these booms is likely to have a substitution and an income effect. The substitution effect stems from the fact that in a boom, wages are likely to be higher, making women's fertility decisions more costly to them if they choose to step out of the labor force even temporarily to have their children. On the other hand, economic prosperity also implies additional resources through labor markets and government transfers which couples can choose to devote to having more children if the latter are a normal good. Which effect dominates is thus an empirical question.

This question is complicated since decisions of income, fertility and marriage are likely jointly taken and thus any correlation between these variables may not provide a causal relationship. The main challenge for such an estimation is that even at the level of an economy, an anticipated increase in fertility can imply a lower labor supply of women and thus inducing a negative relationship between measures of economic prosperity such as the employment rate and fertility rates. Furthermore, when it has been possible, existing papers have not been able to explore issues regarding to birth order, family characteristics and babies' health using a single experiment. Our setting, in a small open emerging economy hit frequently by external price shocks, offers us this opportunity. We use shocks to local geographical entities within Chile stemming from variation in international commodity prices and their relative exposure to it to study the causal impact of local economic booms on fertility decisions, parental characteristics, and on the outcomes of babies born.

We use changes in international commodity prices between 1994 and 2011 as an exogenous shock to local economic conditions. We use a wide set of commodities since there is a large regional difference in natural resources in Chile. In contrast, Feigenberg (2017) uses shocks related to copper and difference in copper resources across regions to explore the impact of aggregate income shocks on school pricing and Álvarez, García Marín, and Illaba (2019) uses shocks to metal prices to demonstrate that commodity booms lead to lower poverty in Chile. We first demonstrate that international price variations in different commodities have significantly and differentially affected regions in Chile. In particular, wood products, salmon, agriculture and mining (each a staple product of different regions of Chile) all experienced different timing of economic shocks over the period analyzed in this paper. Since we are worried about regions specializing in a given commodity in response to international prices, we measure specialization in a Census previous to our period of interest. We then "allocate" the importance of each commodity shock over time to a county

(comuna) depending on its past labor force participation in each sector. This period includes both a permanent increase in commodity prices and cyclical fluctuations. More interestingly, we find that there is important variation across counties in both the timing and intensity of commodity shocks. Thus, we show that these shocks significantly explain variance over time and across regions in employment rates and other proxies of economic conditions in each county of the country (related to the labor market and to government transfers). Given that Chile is a small producer in the world market, it is not likely that these shocks could be endogenous. Thus, we argue that this is a good setting for exploiting an exogenous shock in economic conditions.

We first show that changes in this "price index" significantly affected economic conditions at the local level. Employment, particularly in agriculture and mining, increases in counties when the commodities of which they are better endowed face higher international prices. We also find evidence of increased subsidies, conditional on receiving any, indicating that part of the benefits of the commodity booms may trickle down through other channels than simply those related to the labor market. We show evidence that for most women, these commodity booms are likely to have had a larger income than substitution effect since they seem to increase particularly male employment and government subsidies, conditional on receiving them.

We then estimate the causal impact of these changes in economic conditions on fertility decisions using the census of all births in the country from administrative records. We match the predicted change in economic conditions due to the internal price shocks with the fertility outcomes at two moments: the moment of conception and the moment of birth, at the quarterly level. We find evidence that better economic conditions at the moment of conception (but not at the moment of birth) increase the log number of births and birth rates in the county, suggesting little role for the substitution effect and a much more important role for the income effect. An increase in the weighted price index of a county of 1 percent increases the number of births by 0.3 percent and the birth rate by 0.09 per 1,000 woman (from a base of about 15). Given that the average county in our sample experienced a change in their price index (above that of national variations) of 20 percent, implying that such a shock would generate an impact of about 12 percent of average birth rate and about 6 percent in the number of births.

The fact that more income could lead to higher fertility is central in a Malthusian framework. Studies using historical data from England (Lee and Anderson, 2002), Sweden (Lagerlöf, 2015) and Europe (Galloway, 1988) showed evidence of this pattern historically as fertility responded to short-term variation in grain prices. Our study looks at the post-Malthusian era, where the link between income and fertility may have weakened, as discussed by Chatterjee and Vogl (2018).

The results we obtained are consistent with three recent studies that have looked at local income shocks and their link to fertility. Black et al. (2013) find that coal-rich counties in the United States which suffered a boom due to rising energy prices had also an increase in completed fertility.

Lovenheim and Mumford (2013) find that increases in a family home value increases the probability that this family will have a child and Dettling and Kearney (2014) shows that this is only the case for home owners while higher housing prices decrease the fertility of renters. Kearney and Wilson (2018) look at the fracking boom and shows that it increased fertility but not marriage. Compared to these studies, we argue that our setting is particularly interesting since we are looking at a context in which commodity shocks affected in a different way men and women: while commodity shocks affected more strongly employment rates for men, they affected more strongly subsidies received by women. This suggests that the income effect of the commodity boom would thus be likely to dominate the substitution effect for women.

In an important contribution compared to previous studies, our dataset also allows us to explore whether the identity of the mothers and fathers is also altered. We find evidence that who is likely to be a mother changes in response to commodity booms. When a county is blessed with higher international prices for its commodities, babies are more often born to both university educated fathers and mothers but also to parents with less than a high school diploma, suggesting a polarization in times of economic prosperity. We show that while commodity shocks affect in a stronger way employment opportunities for parents with at least high school education, subsidies received by mothers without a high school diploma are strongly correlated with commodity shocks. In fact, the only group of women for which we find significant employment effects of commodity price shocks are those with high school diplomas. This implies different types of income and substitution effects for different groups of the population. Mothers without secondary education receive mainly income shocks related to public subsidies without much of an effect from labor markets. In contrast, more educated mothers face both substitution effects and income effects related to economic opportunities form themselves and their partners. We also show that babies' fathers are more likely to be employed and more likely to be from a higher occupational category when they are conceived in booms. This suggests that the substitution effect may not operate very strongly because men are experiencing a much larger benefit than women, thus rendering the income effect much more determinant.

We further document that babies who are conceived in periods of booms are less likely to be born to single moms. We actually document that the number of births only increases for married women in these periods. This differs from the results of Kearney and Wilson (2018) where the fracking boom does not alter the fraction of births that occur out of marriage. The authors suggest that this is different than what happened with the coal boom in an earlier period because the stigma for out-of-wedlock births had decreased in the US. However, we do see a fall in single motherhood in a sample that has a majority of birth occurring to unmarried mothers, suggesting that something else than social norms may explain the difference between the impact of fracking and coal. We hypothesize that this is because Chile over this period had limited rules in place to enforce child

payments. Only in 1998 did children born out of wedlock obtained the same rights as those born within marriage and a substantial reform to child payments only occurred in 2000 (for a discussion of the impact these changes may have had, see Martínez A., 2013). Those two dates occur within our sample. We thus suggest that part of the reason for Kearney and Wilson (2018)'s results may have been linked to the fact that modern US has strong enforcement rules for child payments that do not require marriage for the income effect to operate.

We also document that it seems to be the extensive margin of fertility and not the intensive margin that responds to these shocks. The number of first borns is not responding to the price shocks but the fraction of first borns decreases and the birth order rank and the number of children ever born to a woman increase. This suggests that while the timing of starting a family may not be very respondent to the economic conditions, the decision of having subsequent children does depend on income shocks. This again suggests little role for substitution versus income effects since the largest wage cost for a woman would be for her first child. This is also consistent with the very low levels of labor force attachment of mothers in Chile suggesting that for those who already have children, the income effect is likely to be much more important than the substitution effect.

Dehejia and Lleras-Muney (2004) find that mothers who get pregnant during booms are more likely to smoke and drink during their pregnancy leading to worse health outcomes for babies conceived in low unemployment periods in the United States. We find little evidence that babies conceived in periods of economic booms suffer health-wise compared to those conceived in worse economic conditions. This could be because better economic times do not lead to worse behavior by mothers during their pregnancy or because other factors (such as increased resources) are able to reduce the negative impact of these behavior. We do not have information on health behavior during pregnancy like they had in the US thus making it impossible for us to check whether we observe higher incidence of smoking, drinking, using drugs, etc. However, Dehejia and Lleras-Muney (2004) tend to emphasize that substitution effects affect mothers' behavior, which in turn affects newborns' health outcomes. We argue in our case that it seems to be income effects that are driving the results, which may explain why we find different results.

Our paper makes several contributions to the literature. First, we use a plausibly exogenous shock to local economies in the context of an open economy. This allows us to identify effects that are not affected by obvious endogeneity problems. Contrary to the rest of the literature, we document the impact of current economic conditions using high-frequency data, allowing us to focus on the very short-run effect of these shocks on fertility decisions. Second, we are able to map the effect of commodity prices shocks to both labor market opportunities and on government transfers received by parents, which differently affect several groups of the population. This allows us to identify how substitution and income effects may be affecting different economic agents. Third, our dataset allows us to identify how the identify of the parents vary when faced with different

economic conditions. In particular, we identify that most of the increased fertility through the intensive margin. Fourth, we further explore whether the babies born in booms have worse health outcomes and do not find evidence of a significant changes. Finally, a significant contribution of this paper is that we can tackle all these dimensions of the effect of economic conditions on fertility outcomes under one study using the same source of exogenous variation.

The rest of the paper is organized as follows: the next section presents the empirical strategy and Section 3 discusses the data used in our paper. Section 4 then presents the empirical results and the last section concludes.

2 Empirical strategy

The key empirical relationship we wish to estimate is how local economic conditions may influence fertility decisions. Denote an outcome Y_{ct}, e.g., the average outcome of births in county c that were conceived at time t. We would like to correlate this with measures of how well the economy was doing, at that moment in time and in that particular geographical location. We consider commodity price shocks as an exogenous determinant of economic conditions (Z_{ct}). Given the panel nature of our dataset, we can think of the regression we estimate as:

$$Y_{ct} = \beta Z_{ct} + \nu_c + \delta_t + \varepsilon_{ct}$$

where ν_c identifies county fixed effects and δ_t time fixed effects. Thus, we identify the effect of Z_{ct} from within-county, within-time variation. The standard errors are clustered by county to allow flexibly for serial correlation within each county.

Using commodity prices allows us to solve the omission of relevant and unobservable factors biases in the estimation of β when using proxies of local economic activity, such as the employment rate. These omitted variables may be own income, household income, employability, education, etc. We are further plagued by a problem of simultaneity since it may be that fertility influences the fraction of women in the labor force and through that, the employment rate.

We will thus propose an index of shocks generated by international commodity prices. This variable is a source of variation of local economic conditions that would be uncorrelated with local fertility patterns and labor supply decisions. However, since we want an index at the local geographical level, we must generate a way in which these international commodity prices affect different regions of a country at the same time. Our solution is to weight the impact of different commodities by the importance of each commodity in the local economy. While this can be done in many different ways, the easiest one and the one for which we have the best data is the employment share of these sectors in a period before shocks are measured. Formally, our commodity price index

be

$$Z_{ct} = \sum_{i=1}^{7} \frac{N_{ci1992}}{N_{i1992}} * P_{nt}$$

where N_{cnt} represents the number of workers employed in sector n, in county c in quarter t and P_{nt} the price index of sector n over time. Thus, our price index documents in which regions would the price of production have increased more rapidly if the industrial composition had remained the same as in 1992 since this is closest census to the data we are analyzing that is completely available in summary tables by Redatam, a subdivision of CEPAL (Redatam, Cepal, 2013). We thus prevent regions from increasing their involvement into a particular sector in response to price shocks to make sure that supply factors do not influence our measure. We include 6 different sectors of relative importance in Chile namely copper, other metal mining, agriculture, petroleum, fisheries and forestry. We also include a residual sector which includes services and manufacturing so that the weights sum to 1 in each county. We assign to these sectors prices of commodities that are relevant to them: copper, metals, food, petroleum, fish flour and cellulose, respectively. We obtain the first two from the International Monetary Fund (International Monetary Fund, 2013) and the last four from SOFOFA (Sociedad de Fomento Fabril F.G. (SOFOFA), 2013). For the residuals, we assign it the Wholesale Price Index for domestic manufacturing, published by the Chilean Central Bank. We normalized all price indices to be equal to 1 in 2005.

For example, let us assume that county A had 80% mining and 20% of agriculture and county B had no mining activity but 90% agriculture in 1992. Our price index thus would imply that when food prices are on the rise, the second county would have a larger predicted price index while it would not influence much county A. On the opposite, if copper prices are increasing, then county A would see its economic activity improve but not county B. Given that our regression includes fixed effects for county and quarter, we are exploiting how the change over time in county A will differ from county B, taking into account that these two counties are very different and thus may have different levels of fertility.

What are the challenges with using this index as a valid source of exogenous variation? First, we may think that the importance of a commodity in a given county is endogenous to the changes in the prices that would be anticipated and somehow correlated with fertility decisions. However, we can easily think that the specialization levels of each region in Chile are much more likely to be correlated with natural resources endowment than with anticipated price shocks. Thus, it is unlikely that changes in endowments would be correlated with fertility decisions, in particular at a quarterly frequency, which is the time-horizon our data provides us with. There is also no evidence that 1992 would be a particularly special year in Chile's economy, thus leading us to believe that using the fractions from that year would not likely contaminate our results.

As is usual in this type of proxy, we must also show that the price indices are not responding

to local conditions. Given that we use prices of commodities determined on world markets, it is difficult to believe that Chile, a relatively small economy, would have a large influence over those. The only good where Chile is a relatively large player is copper where it gathers about 35 percent of the world's production. Despite that, the market for copper is determined on metal stock markets with strong competition forces. We thus see as unlikely that local economic conditions in copper-producing regions of Chile would significantly affect world prices. Furthermore, a large amount of fluctuations in the price of copper over the period we are analyzing was more linked to demand forces than supply.

Figure 1 provides a graphical representation of the evolution of this index for a random sample of counties in Chile. Panel A presents the raw index. It is noticeable that while there is synchrony across counties in the evolution of commodity prices, there is a lot of variation across time and space in terms of the size of the shocks. Given that we exploit variation within counties in these shocks, Panel B presents the residuals after regressing the index of commodity prices on county and time dummies. This is much closer to the variation we use in our regressions and shows the sizeable changes we exploit across time and counties in Chile.

3 Data

To perform the estimations we presented above, we need to measure birth outcomes at a high frequency in each county of Chile over a long enough horizon to observe commodity price fluctuations. We employ the census of all births in the country between 1994 and 2011, from the Departamento de Estadísticas e Información de Salud, DEIS, which is part of the Ministry of Health (Departamento de Estadísticas e Información de Salud, 2013). While not freely accessible, researchers who justify the purpose of their query can obtain access through a web page. The database includes every single birth, codified by the date of birth of the child and the county of residence of the mother. The database is amazingly rich including information regarding the gender, weight and gestational age of the baby and details regarding the delivery (doctor versus midwife, at home versus hospital, etc). It also includes a large set of information regarding the parents: education, age, urbanicity, marital status, labor force status and occupation. However, it does not include information about prenatal care nor actions taken by mothers during their pregnancy. Aggregated by quarter of conception and county leads to a group of 346 counties and 69 periods for a total of 23,874 observations. To construct natality rates, we must also count on the number of women in each county. We rely on the intercensal estimates of the Instituto Nacional de Estatisticas, INE (Instituto Nacional de Estadísticas, 2013b).

In addition, we implement a robustness check of our empirical strategy using conditions in place at the moment of birth, given that our theoretical argument concerns conditions at the time

of conception and not at the time of birth. In order to implement this exercise, we also aggregate the data by quarter of conception, quarter of birth, and counties. In general, quarters of conception have 2 and up to 3 different quarters of birth link to them (premature, on schedule and late births). This makes our database much larger reaching more than 50,000 observations. Nevertheless, most results are unchanged by the use of one aggregation or the other.

We also use data for several economic outcomes. We use two sources of information. First, we use employment rates at the regional level from INE (Instituto Nacional de Estadísticas, 2013a). Since we do not have the information at the county-level, we assign to each county the data for the employment level of the region it belongs to. Second, we also use the household survey (CASEN), which is available at the county level but at a bi- or tri-anual basis, leaving us without the high frequency variation we sought to generate. Using this survey we construct the employment rate and several measures for mean income at the county level (total income, labor income, and income from subsidies). This survey also allows us to identify variation in economic outcomes by parents' educational levels, which we exploit to understand mechanisms behind our results.

Table 1 presents the main characteristic of our basic sample. On average, we observe about 180 births per quarter per locality, translating into an average rate of 14 births per 1,000 women. Of these births, about 42 percent are first births while the average birth makes the woman have her second child. Thirty percent of all births are under the supervision of a doctor, while 68 percent are attended by a midwife. Almost all births are within a hospital or clinic and are simple births. Health-wise, only a very small fraction of babies are very premature and very low birth weight. About 5 percent weighted less than 2.5kg. This period is one where children are more and more likely to be born out of wedlock with, on average, about 57 percent of births being to single mothers.[1] Finally, at the moment of the birth, 84 percent of fathers are working but only 20 percent of the mothers are. About 4 percent of both mothers and fathers report high-earning occupations. This is even lower than the fraction who completed university education (13 percent of women, 15 percent of men). On the other hand, 57 percent of mothers and 50 percent of fathers had not completed high school. Average mother's age is about 26 years.

4 Empirical results

4.1 Commodity Prices and Economic Outcomes

In order to understand how commodity booms can impact birth outcomes, we explore how our price index measure impacted economic variables. We demonstrate that there is a strong relationship between our predicted price index and the proxy for economic activity we have available

[1] Chile now is the OCDE country with the most out-of-wedlock births at 71.1 percent in 2014.

for a big sample, namely the employment rate. Table 2 presents the relationship between economic activity and the commodity price index. We find a very strong relationship between the employment rate and the index, whether we measure it at the regional level but at quarterly frequency, like in column (1), or at the county level but at an bi-annual frequency in the CASEN, like in column (2). We then show that the results are similarly strong at the beginning or at the end of the period (in the next two columns). Finally, we also show that we can exclude some key regions like the metropolitan region of Santiago or the North (where most of the mining industries are concentrated) and the results remain as strong, as can be seen in the last two columns.

In order to convince the reader that our price index does capture the margin we wish to measure, Table 3 further studies the effects of commodity prices by dividing the sample by the sector of the economy where people are working. Results confirm the empirical validity of our index. Commodity-intensive sectors (agriculture and mining) expand when international price shocks raise the value of their output while manufacturing shrinks (it is negatively impacted by the terms of trade that are generated by commodity booms). Service sectors are unaffected. Finally, note that labor income is non-responsive, emphasizing the role of employment as being more relevant than income for the average population. This is due in part to the fact that we used labor income conditional on employment. This suggests that the gain in income that the population may have seen stem from entry into employment and not increases amongst those with an employment.

Since our hypothesis is that the impact of the commodity boom on natality will depend on the relative strength of the substitution and income effect, it is important to detail whether female employment or income is more likely be affected by these booms. We thus explore how our price index affects several margins of employment and income for the complete sample and across genders. We can only do these exercises using the data from CASEN but it is still illustrative of how international commodity prices appear to affect different margins of local economic conditions. Table 4 shows, in the first column, the aggregate result where the top panel replicate the second column of Table 2. The first panel indicates that in aggregate, the shock affected only employment rates and income related to subsidies, as shown in columns (3) and (4). Labor income, on the other hand, does not appear to rise. Panels B and C next separate this by gender and indicate in part the reason for this pattern. Only men's employment rates respond to the commodity prices, something that is reassuring since the commodity sector is highly male-dominated. Once more, we see no impact of the price shocks on labor earnings, indicating that the commodity prices mostly stimulated employment without changing wages. The aggregate increase in government transfers appears to be highly concentrated among women. Government subsidies are measured as average subsidies conditional on receiving one. While not reported here, when we estimate the impact on the unconditional mean transfer, we find the opposite sign as the one reported here. Thus, in times of local economic abundance, the fraction of the population that receives benefits shrink but those

who receive them receive more. This is in part due to the fact that the transfers are regressive. Thus, as there are better economic conditions, some individuals are no longer eligible for government subsidies but those who remain would receive more. Once we look at this more carefully, we find that this is due to transfers that are linked to the number of children that poor individuals have under their supervision ("subsidio unico familiar" or SUF in its Spanish acronym). Thus, we see this result on income as being another reflection of the main result of our paper: better economic conditions lead to more children being born which raises the transfers made by the government. Overall, these results would point to commodity prices impacting natality mostly through an income effect for mothers as long as resources can be transferred from fathers to mothers.

4.2 Impact on natality

Having shown that our price index is strongly altering local economic conditions and increasing women's income and fathers' employment, we now turn to exploring how these local economic shocks affected fertility-related outcomes. In Table 5, we show the effect of our commodity price index on several measures of fertility. In column (1) we look at the birth rate while in column (2) we present the log number of births. We find evidence that an exogenous shock to local economic conditions leads to higher fertility, as measured by both the birth rate and the log number of births. This replicates existing results causally estimated in other contexts, that is evidence that more income leads to more births. In terms of economic effects, an increase in the weighted price index of a county of 1 percent increases the number of births by 0.3 percent and the birth rate by 0.09 per 1,000 woman (from a base of about 15). Given that the average county in our sample experienced a change of the price index of 20 percent over the period, this imply that such a shock translated into a 12 percent increase of the average birth rate and about 6 percent increase in the number of births. One may worry that this result is spurious and driven by trends in the data. While it is really impossible here to use an event study methodology to claim that only economic conditions at the time of the conception are responsible for the effect we document, we find that including the values of the price index for the quarter previous to conception does not affect the magnitude of the coefficient of the conception's price index on the log number of births and the birth rate, although it decreases precision. Appendix Table A.1 shows this.

One may be worried that the positive effect we find on natality would be due to migration of women to booming zones, leading to a higher number of babies being born because more women are locating there. This would not be the channel we are hypothesizing is at play. Appendix Table A.2 shows that there is no indication that the total population nor the fraction of men in a given county increased in response to an increase in local economic conditions. We measure total population, in the first column, through the extrapolation provided in the Census; in the second column, we use the CASEN survey. The third column looks at the fraction of males in the economy. We find

no statistically significant coefficient in the table. This suggests that the pattern we identify is not driven by migration.

However, this positive effect could be linked to the fact that some women have more children or because more women have one child. Our data, compared to previous work, has the richness to allow us to make this distinction, as shown in columns (3) to (5) in Table 5. Column (3) regresses the fraction of births that were born from first time mothers in each quarter on our price index at the moment of conception. In turn, columns (4) and (5) present the coefficient of our price index on the average rank of the birth and the average rank of the child, respectively. The difference between these two stems from child deaths.[2] What our results suggest is that exogenous local income shocks are less likely to lead to births to first-time mothers and more likely to increase higher-order births. This is likely to be related to the income versus substitution effects that local income shocks may generate in terms of fertility. For first-time mothers, who are likely to be working at the time of conception, an improvement in economic opportunities may reduce one's incentives to want to interrupt their work life to have a child. This would imply that for them, the substitution effect dominates. On the other hand, for women who already have had a child and who are less likely to be working, better local economic conditions may have mostly an income effect due to increases in their partner's income and through more government transfers. In response to better conditions, these women appear to decide to expand their existing family. Actually, Appendix Table A.3 shows that local income shocks only affect the number of non-first borns with a zero effect on the number of first borns. This is consistent with this rationale. The magnitudes are such that the change in the price index experienced by the average county over this period altered the fraction of birth to first time mothers by about 1 percentage point and increases the number of births that a mother has had by about 0.03.

4.3 Impact on parent's identity and out-of-wedlock births

Having shown that more favorable economic conditions driven by higher international commodity prices increase fertility, in particular on the extensive margin, we now check whether the identity of parents changed in some observable characteristics. Again, we anticipate that women for which the substitution effect dominates would be likely to decrease their fertility in response to commodity booms but that women for whom the income effect dominate would have more children.

The first columns of both panels of Table 6 show that in periods of booms, both low-education and high-education parents seem to have more children. This is because we see a positive and large coefficient on the fraction of mothers and fathers who were university educated and a negative coefficient on the fraction of parents with high school education. Given that the sum of the two

[2] In analyses not reported here but available upon request, we find that there is no effect of our price index on the fraction of children born in multiple births.

coefficients is negative, this tells us that we also saw an increase in the fraction of mothers who have less than high school education (for fathers, the sum is 0). This may be because these women see the income effect of the shock, one because they are poor and receive government transfers and the others because they have high earning spouses who benefit from the shock. The magnitudes are such that an increase of 1 percent in the local price index increases the probability that a birth occurred to a university educated mother by 0.07 percent and to a university educated father by almost 0.09 percent. The fall in the probability that the birth occurs to a high-school graduate falls by 0.1 percent for mothers and 0.09 percent for fathers.

We then look at the probability that the parents report working at the time of the birth. We find that mothers and fathers are more likely to report that they were working at the moment of the birth if the baby was conceived at a moment of good local economic conditions. However, the coefficients are not significant for both genders. Moreover, the results also suggest that babies conceived during commodity booms are more likely to have parents who are of high occupational categories. Since we did not observe an increase in the fraction of women employed in the aggregate data, we find this suggesting that the type of parents has been altered towards individuals who are more likely to have high-ranked occupations in times of economic booms. The magnitudes are such that a one percent increase in the price index increases the probability of having a birth registered to a father or mother who occupies a high-rank occupation by 0.04 percent. While not presented here, we find no evidence of changes in the age distribution of parents, suggesting that these effects are not linked to older or younger parents being more represented when a boom occurs.

Finally, the last column estimates the impact of better economic conditions on the probability that the parents are unmarried. We only include information regarding the mother since marital status of the father is not measured and we assumed it to be the same as the mother. We find that babies conceived in times where local economies are benefited by international commodity price booms are less likely to be born to a single mother than those born in less favorable periods. The impact is noticeable with a one percent increase in the price index translating into a 0.04 percent lower probability that the mother be unmarried. This could be because periods of booms lead to more marriages and, since there are more married individuals, more babies are born to married mothers, or because there are more births to married women than unmarried women, keeping their marital status as fixed. We find, when regressing the marriage rate against our proxy of economic shocks, that the coefficient is small and not statistically significant, suggesting that the second hypothesis is more likely to be at play.[3]

This raises the question about whether the effect we found on the extensive margin of fertility stems only from the fact that fewer single mothers are having children and that they have a higher propensity to have only one child. In analyses not reported here but available upon request, we

[3]Results not presented here but available upon demand.

find that while a fraction of the fall in first born is driven by the decrease in the fraction of births to single mothers, even within the group of single mothers, we find a significant and negative impact of better local economic conditions on the probability of having a first born. This suggests that for unmarried mothers, better economic conditions also appear to reduce the probability of starting a family. The effect for an increase in birth order is, correspondingly, larger and more significant for married mothers.

This differs from the results of Kearney and Wilson (2018) who find that the fracking boom increased fertility but did not reduce the share of birth that were out-of-wedlock. We argue that the difference here is not because there is a large stigma to having a child out-of-wedlock in Chile (as the authors argue was the case in the 1970s during the coal boom) since the majority of births in our sample occur out of wedlock. However, despite non-marital births being very frequent, legal obligations of unmarried fathers were relatively weak over our period of analysis compared to modern US period. For example, only in 1998 did the law officially equalized the rights of children born within and out of marriage (Martínez A., 2013). The most recent law on child support payments was only approved in 2000 and there is evidence that it is not well applied even today.

4.4 Health outcomes

Finally, since previous literature has highlighted a potential link between economic conditions and health of newborns (see Dehejia and Lleras-Muney, 2004), we explore the link between commodity booms at the time of conception and a number of measures of birth conditions and the health of the new babies. Table 7 presents, in the first two columns, whether a doctor, a midwife or none of the two was attending the birth. It must be noted that births in Chile are usually attended by a midwife who is a trained nurse. In private hospitals and in difficult cases, this is supplemented with a doctor. We then use an indicator variable of whether the birth occurred at a hospital or not. Column (4) then measures whether the birth occurred before 28 weeks of gestation while column (5) uses the average gestational age. Finally, the last 2 columns indicate whether the baby was born with a weight of less than 2.5kg and 1.5kg, respectively. We document that there seems to be little impact of economic conditions at the moment of conception on who is attending the birth or health outcomes of newborns. Two of the coefficients suggest a significant relationship between conditions at the time of conception and conditions at birth. We observe that being conceived in a local boom leads to a lower probability of being born in a hospital and a lower gestational age. However, not only many of the coefficients are not significant but the magnitudes are also small. A one percent increase in the price index would increase the probability of the birth being attended by a doctor by 0.01 percent; the probability that the birth be premature by 0.01 percent; the probability that the birth be low birth weight by less than 0.01 percent. We observe a statistically significant negative impact of better economic conditions on the probability of having a birth in a hospital. A one

percent increase in the price index would decrease the probability of a birth occurring in a hospital by 0.03 percent. Given the fact that almost all babies close to urban areas are born in hospitals, we see this as suggesting that women in rural or more isolated areas are more likely to have a birth in times of commodity booms and that this translates into a few more births outside of the hospital. Gestational age is lowered statistically significantly but the magnitude is also small: a one percent increase in the price index would lead a baby to be born 0.002 weeks earlier.

We then turn to how economic conditions at the time of conception affect the likelihood that babies be born with health difficulties. We do not have the APGAR score but use gestational age and birth weight as measures of health at birth. We find no evidence that the causal relationship between these variables and income shocks to be significant. This seems to suggest that in this context, we do not find that the "marginal" children conceived in periods of booms are more likely to suffer health difficulties at birth. The fact that our results differ from Dehejia and Lleras-Muney (2004) could be in part due to the fact that we do not use correlations but instead focus on a causal channel. However, in unreported analyses, we also find no significant relationship between health of babies and our measure of employment rate. This may be because marginal women in Chile receive better prenatal care than in the US. However, our results point mostly to the fact that the marginal woman who decides to have a child in good economic times experienced mostly an income effect, in great part because of more involvement by the father and by larger subsidies from the state.

One may worry that the absence of health effect is driven by the fact that we use only the economic conditions at the moment of conception and that the second or third trimester may be more relevant. However, as we will discuss in the next section, we find limited impact of economic conditions at the moment of birth and adding a control for the second trimester also does not seem to alter our results.

5 Further Analyses

We have thus shown that exogenous shocks in local economic condition at the time of conception significantly raises the probability that babies be born 9 months later, mostly through the intensive instead of the extensive margin. It also changed the characteristics of who is having children, decreasing out-of-wedlock births and increasing the probability of having a working father. In this section we present exercises that try to implement robustness checks to alternative explanations for the patterns we identify and also to study in more detail the mechanisms behind our results.

5.1 Birth versus conception

While we have so far argued that our results highlight the fact that when economic conditions are better, some individuals decide to conceive more babies, an alternative interpretation would be that when economic conditions are better, more babies are carried to term. Furthermore, the fact that more babies are born to parents with given characteristics could not be due to the fact that these parents decide to conceive more children but that economic conditions at the time of birth are influencing what they report on the birth certificate.

To explore this in more details, we first reconstruct our data by quarter of conception AND quarter of birth. Given that babies are born at different gestational age, this implies that we usually have 2 or 3 quarters of birth for every quarter of conception. We then generate another price index which this time measures exogenous shocks at the time of birth, instead of conception. These two measures are clearly correlated but still provide some differences that can be exploited. Thus, the thought experiment is now the following. Take two babies that were born in the same quarter of birth but were conceived in different quarters. One of these babies had a quarter of conception that had better local economic conditions than the other because of shifts in international commodity prices. Are the characteristics of these two babies likely to be different?

Table 8 shows, for a few outcomes, the results of combining both price indices in a single regression. The first two columns suggest that our aggregate fertility result is solely driven by changes in economic conditions at conception and not at birth. This is not surprising given the low level of perinatal mortality in Chile. Columns (3) and (4) then examine our results on extensive and intensive margins. We find that the negative impact on the probability that the baby be a first born remains but loses significance once both variables are included. The increase in the number of children born to each mother does keep its significance but its magnitude is decreased. Given the high correlation between the two price index measures, we see this as suggesting that our results are not driven by economic conditions at birth but rather a change in the family fertility's decisions. Finally, the last column explores whether our compositional measures may also depend on the conditions at birth. We find no evidence that the rate of single motherhood is lower because good economic conditions at birth generate more shotgun marriages. The results suggest that our interpretation that more married women choose to have children in good economic times is maintained. While we only present this outcome, we find similar conclusions for all of our compositional measures, suggesting that our results are not driven by changes in characteristics between the moment of conception and that of birth but instead in a fertility reaction of different types of individuals to the local commodity booms.

5.2 Composition versus behavioral changes

We have previously shown that the educational composition of mothers is altered by the exogenous economic shock we exploit. We now explore whether the other results we document may be entirely driven by this shift across educational groups.

To do so, we re-estimate all of our regressions but separately by educational attainment group of the mother, dividing it by the same way as we had in Table 6. The top panel of Table 9 thus shows the impact of the economic shocks to fertility outcomes of mothers with less than high school, Panel B focuses on high school educated mothers, and the bottom panel on university educated mothers. We focus on a few outcomes but the results are similar when looking at others. Specifically, we look at whether the birth correspond to the first one in Column (1), to the number of children in column (2), to the fraction of births to single mothers in Column (3) and finally, to the characteristics of fathers in the last two columns. In addition, Table A.4 presents the effects of commodity price shocks on economic outcomes for different education*gender groups in order to complement the analyses we present.

We find that most of our conclusions do not appear to be driven by compositional changes. We even find that some of the changes within educational groups were hidden in aggregates. The first column of Table 9 suggests that the decrease in the probability that children conceived in a given quarter were first born is particularly strong for women with high school diplomas, which is consistent with the existence of a substitution effect for these mothers. The only group for which we observe a small and insignificant increase in the probability of a first born is the group without high school for which the income effect appears to dominate even for the extensive margin of fertility decisions. The increase in the intensive margin is found most strongly for the lowest two educational groups of the mothers. For university educated women, we do not see a statistically significant pattern.

We then look at the probability that a child be born to a single mother and do not find a statistically significant relationship for any of the groups. The negative aggregate pattern is observed for the two highest educational categories. However, we lose much precision by conducting the regression analysis separately by educational category, thus implying that none of the effects are statistically significant.

Next, we study how the characteristics of the father change depending on how local economic conditions are moving. We find that the non-statistically significant relationship between external price shocks and the probability of the father being employed hides heterogeneity by mother's educational level. For all mothers with at least a high school diploma, we find that good local economic conditions lead them to be more likely to declare that the father is employed at the time of the birth. However, for mothers without a high school diploma, the effect is opposite. This

suggests that women without a high school diploma are more likely to have babies with men who can provide less economically when faced with better local economic conditions while the opposite is true for mothers of higher educational category. This may be due to the fact that the first group can rely on more generous government benefits in periods of booms.

To interpret these results better, we would need to understand how the economic shocks we detail impact men and women of different educational attainment. This requires cutting our annual CASEN data quite finely. In results presented in Appendix Table A.4, we suggest that the only group of women for which there was a significant positive effect of commodity price shocks on employment rates were women with high school diplomas. This implies the potential existence of substitution effects that create a disincentive to have more children. In turn, low educated women see big increases in government transfers in periods of commodity booms. Taken together, this suggests the income effect leads these poor income women to be willing to bear the cost of having a child, even without a father present, while this is not the case for women from higher socio-economic groups.

Overall, we thus find little evidence to believe that the aggregate results we documented in the main part of the paper are simply due to a changes in the educational attainment of women and not also to changes in behavior of these different women in our sample. In fact, our results suggest that different types of income effects explain the pattern we observe at the aggregate level: while low educated women receive significantly more government transfers during periods of commodity booms that induce them to have more children, university educated women face increases in the income of their partners that induce them to have more children. The only group for which there seems to be a strong substitution effect is for women with high school diplomas.

5.3 Trends versus short-term fluctuations

As we argued in the introduction, no other study on this topic has been able to explore such high-frequency birth data to explore the relationship between cycles and fertility outcomes. While this is an advantage, it also questions whether our results are driven by "trend" shifts in local economic conditions or by more short-term variations. To explore this, we separate our local price index into 2 components (trend and residual) using a Hodrik-Prescott filter. We have limited capacity to do such decomposition since the ingredients of our price index are common across all regions. Nevertheless, we obtain significant differences by local area. The results using each ingredient of that decomposition in our main outcomes are presented in Appendix Table A.5. What can be seen there is that while both the trend and the cycle component of our price index appear to influence fertility outcomes in a consistent manner, the results are substantially more precise for the trend than the cycle component. This would suggest that the longer-term variations in local economic conditions appear to drive the main fertility results more strongly than very short-term

fluctuations. This also gives support to the idea that income effects are more important than substitution effects in explaining our results.

6 Conclusions and future research

Overall, this paper has shown that births are procyclical when measuring income shocks using a plausibly exogenous shock to local economic conditions stemming from international price changes. We are able to show that this is much more due to families getting larger than to new families forming. We document also a change in the identity of the parents and limited impact on health outcomes of newborns. Overall, this seems to suggest a strong income effect and a very limited substitution effect in response to the local economic shocks.

Our results also suggest that commodity price booms affect fertility rates through both labor market opportunities and government transfers. Moreover, the fact that commodity prices affect in a differentiated way people with different skill levels suggest that public policy reactions to commodity shocks matter to understand the patterns of reactions of agents. We think that this is interesting since it suggests that local communities may benefit in more ways than one from these commodity price booms. The fact that the intensive margin responds more than the extensive one also sheds important light over the relative opportunity costs faced by women starting a family versus increasing their number of children. We think that this is important policy lesson since this margin has been hidden previously for lack of data.

Our results also highlight the potential beneficial impact of local economic conditions on fatherly presence at the moment of birth. This is particularly interesting given the beneficial impact seen in other settings of better involvement of fathers. We think that this is an interesting avenue of future research.

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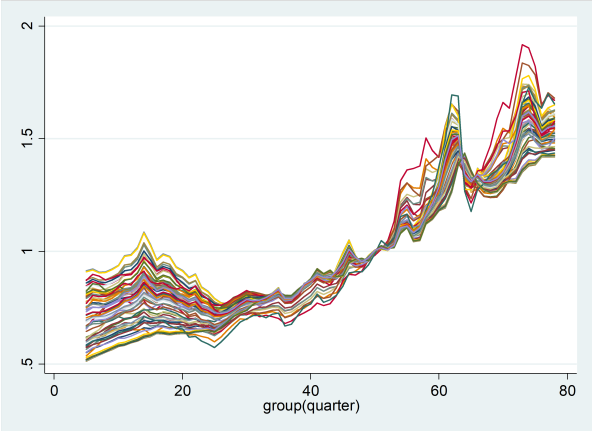
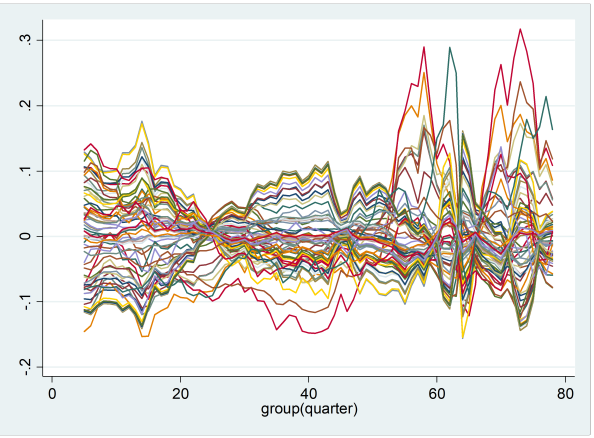
7 Figures and Tables

Figure 1: Commodity price index for random sample of counties



(a) Panel A: Raw Index



(b) Panel B: Within Country Variation of Index

Table 1: Summary Statistics

Variable	Observations	Mean	Standard Deviation
Fertility Outcomes			
Births by county	24938	181.14	295.41
Ln(births)	24938	4.145	1.609
Birth rate	24894	14.75	19.03
First born rate	24409	0.418	0.111
Number of children	24409	2.019	0.336
Number of births	24409	2.060	0.353
Health Outcomes			
Premature (less than 28 weeks)	24409	0.003	0.013
Gestational Age	24383	38.739	0.471
Low birth weight	24383	0.054	0.053
Very low birth weight	24383	0.009	0.021
Presence of doctor at birth (rate)	24409	0.310	0.191
Presence of midwife at birth (rate)	24409	0.681	0.193
Birth at hospital (rate)	24409	0.983	0.067
Simple birth	24382	0.984	0.032
Mothers Characteristics			
Single mother rate	24409	0.575	0.168
Mother working (rate)	24397	0.205	0.155
Mother of High Rank Occupation	24409	0.039	0.069
University educated mothers	24396	0.135	0.135
High School educated mothers	24396	0.294	0.150
Mothers with less than HS education	24396	0.571	0.198
Mother's age	24383	25.797	1.691
Fathers Characteristics			
Father working (rate)	24409	0.839	0.216
Father of High Rank Occupation	24409	0.044	0.078
University educated fathers	24409	0.150	0.147
High School educated fathers	24349	0.278	0.153
Fathers with less than HS education	24409	0.494	0.185

Notes: Authors calculations at the county times quarter of conception level using information from the Census of Births (Departamento de Estadísticas e Información de Salud, 2013).

Table 2: Impact of exogenous economic shocks on employment rate

Sample	(1) INE	(2) CASEN	(3) INE before 2002	(4) INE after 2002	(5) INE Exc. Santiago	(6) INE Ex. North
Price Index	0.025***	0.031**	0.024***	0.021***	0.018***	0.015***
	(0.005)	(0.014)	(0.008)	(0.006)	(0.007)	(0.005)
R^2	0.846	0.735	0.868	0.866	0.815	0.867
N	24,938	2,259	12,132	12,806	21,090	21,756
Mean (s.e.) of	0.499	0.483	0.490	0.507	0.491	0.498
dependent variable	(0.040)	(0.069)	(0.037)	(0.041)	(0.039)	(0.040)

Notes: Regressions include time and county fixed effects. Robust standard errors clustered at the county level in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 3: Impact of exogenous economic shocks on employment rate and income by sector, CASEN

	Aggregate (1)	Agriculture (2)	Manufacturing (3)	Mining (4)	Services (5)
			Panel A: Employment Rate		
Price Index	0.031**	0.041**	-0.026***	0.015*	0.001
	(0.014)	(0.017)	(0.007)	(0.008)	(0.017)
R^2	0.735	0.860	0.730	0.892	0.868
N	2,259	2,259	2,259	2,259	2,259
Mean (s.e.) of	0.483	0.143	0.048	0.013	0.278
dependent variable	(0.069)	(0.109)	(0.033)	(0.032)	(0.106)
			Panel B: Labor Income		
Price Index	0.034	-0.035	-0.056	-0.254	-0.016
	(0.071)	(0.136)	(0.182)	(0.241)	(0.074)
R^2	0.816	0.635	0.584	0.547	0.733
N	2,259	2,207	2,235	1,377	2,259
Mean (s.e.) of	12.546	12.513	12.595	12.932	12.733
dependent variable	(0.403)	(0.537)	(0.543)	(0.754)	(0.379)

Notes: Regressions include time and county fixed effects. Robust standard errors clustered at the county level in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 4: Impact of exogenous economic shocks on Employment rate and income by gender, CASEN

	Employment rate (1)	Labor income (2)	Subsidy income (3)	Total income (4)
		Panel A: Complete sample		
Price Index	0.031**	0.034	0.133*	0.157**
	(0.014)	(0.017)	(0.007)	(0.008)
R^2	0.735	0.816	0.835	0.834
N	2,259	2,259	2,259	2,259
Mean (s.e.) of	0.483	12.546	9.810	12.460
dependent variable	(0.469)	(0.403)	(0.466)	(0.422)
		Panel B: Women		
Price Index	0.012	-0.040	0.383***	0.210**
	(0.019)	(0.090)	(0.104)	(0.087)
R^2	0.756	0.751	0.691	0.791
N	2,259	2,259	2,258	2,259
Mean (s.e.) of	0.304	12.223	9.908	12.069
dependent variable	(0.093)	(0.400)	(0.442)	(0.439)
		Panel C: Men		
Price Index	0.037**	0.058	-0.069	0.094
	(0.018)	(0.076)	(0.092)	(0.077)
R^2	0.638	0.812	0.819	0.818
N	2,259	2,259	2,258	2,259
Mean (s.e.) of	0.669	12.694	9.723	12.661
dependent variable	(0.076)	(0.443)	(0.531)	(0.448)

Notes: Regressions include time and county fixed effects. Robust standard errors clustered at the county level in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 5: Impact of exogenous economic shocks on fertility

	Birth rate (1)	Log births (2)	First born (3)	Number of children (4)	Number of births (5)
Price Index	8.840*	0.269***	-0.049***	0.156***	0.152***
	(5.225)	(0.097)	(0.014)	(0.040)	(0.040)
R^2	0.145	0.967	0.122	0.256	0.257
N	24,894	24,938	24,409	24,409	24,409
Mean (s.e.) of	14.749	4.145	0.418	2.019	2.060
dependent variable	(19.033)	(1.609)	(0.111)	(0.336)	(0.353)

Notes: Regressions include time and county fixed effects. Robust standard errors clustered at the county level in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 6: Impact of exogenous economic shocks on fertility by parents' education

	University educated (1)	High school educated (2)	Employed (3)	High-rank occupation (4)	Single (5)
			A. Mothers		
Price index	0.067***	-0.098***	0.013	0.042***	-0.040**
	(0.015)	(0.017)	(0.013)	(0.012)	(0.016)
R^2	0.724	0.614	0.679	0.617	0.629
N	24,396	24,396	24,397	24,409	24,409
Mean (s.e.) of	0.134	0.294	0.205	0.039	0.575
dependent variable	(0.135)	(0.150)	(0.155)	(0.069)	(0.168)
			B. Fathers		
Price index	0.086***	-0.086***	0.014	0.045***	
	(0.014)	(0.019)	(0.011)	(0.010)	
R^2	0.735	0.589	0.899	0.677	
N	24,349	24,349	24,409	24,409	
Mean (s.e.) of	0.150	0.278	0.840	0.044	
dependent variable	(0.147)	(0.153)	(0.216)	(0.078)	

Notes: Regressions include time and county fixed effects. Robust standard errors clustered at the county level in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 7: Impact of exogenous economic shocks on health outcomes

	Attended by doctor (1)	Attended by midwife (2)	Born in hospital (3)	Premature (4)	Gestational Age (5)	LBW (6)	VLBW (7)
Price index	0.010	-0.023	-0.030**	0.013	-0.228***	0.008	0.004
	(0.039)	(0.039)	(0.014)	(0.010)	(0.057)	(0.006)	(0.003)
R^2	0.685	0.665	0.465	0.123	0.287	0.074	0.055
N	24,409	24,409	24,409	24,409	24,383	24,383	24,383
Mean (s.e.) of	0.310	0.681	0.983	0.058	38.739	0.009	0.054
dependent variable	(0.191)	(0.193)	(0.067)	(0.056)	(0.471)	(0.021)	(0.053)

Notes: Regressions include time and county fixed effects. Robust standard errors clustered at the county level in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 8: Impact of of exogenous economic shocks at conception and birth

	Birth rate (1)	Log number of births (2)	First born (3)	Number of children (4)	Single mothers (5)
Price index	4.730**	0.584***	-0.010	0.097*	-0.052**
at conception	(1.978)	(0.138)	(0.023)	(0.058)	(0.020)
Price index	-1.359	-0.066	-0.019	0.062	0.007
at birth	(1.098)	(0.132)	(0.022)	(0.055)	(0.022)
R^2	0.443	0.547	0.041	0.095	0.329
N	50,620	50,645	50,627	50,627	50,645
Mean (s.e.) of	7.253	3.177	0.419	2.019	0.573
dependent variable	(12.260)	(1.711)	(0.196)	(0.512)	(0.228)

Notes: Regressions include time and county fixed effects. Robust standard errors clustered at the county level in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 9: Impact of exogenous economic shocks on fertility decisions, by education of the mother

	First born (1)	N. of Children (2)	Single mothers (3)	Father employed (4)	Father high occ. (5)
			Less than high school diploma		
Price index	0.009	0.112**	0.014	-0.060***	0.001
	(0.017)	(0.050)	(0.022)	(0.016)	(0.002)
R^2	0.092	0.179	0.562	0.852	0.270
N	24,227	24,227	24,227	24,227	24,227
Mean (s.e.) of	0.370	2.194	0.622	0.827	0.007
dependent variable	(0.129)	(0.393)	(0.179)	(0.226)	(0.217)
			High school diploma		
Price index	-0.061**	0.087*	-0.026	0.036***	0.007
	(0.024)	(0.050)	(0.022)	(0.014)	(0.006)
R^2	0.104	0.121	0.438	0.813	0.175
N	22,407	22,407	22,407	22,407	22,407
Mean (s.e.) of	0.487	1.767	0.556	0.841	0.031
dependent variable	(0.179)	(0.345)	(0.215)	(0.232)	(0.062)
			University		
Price index	-0.000	-0.022	-0.025	0.054***	0.085***
	(0.035)	(0.070)	(0.033)	(0.020)	(0.028)
R^2	0.062	0.099	0.297	0.647	0.262
N	21,696	21,696	21,696	21,696	21,696
Mean (s.e.) of	0.510	1.716	0.447	0.841	0.204
dependent variable	(0.259)	(0.502)	(0.285)	(0.253)	(0.223)

Notes: Regressions include time and county fixed effects. Robust standard errors clustered at the county level in parentheses. *** p<0.01, ** p<0.05, * p<0.1

A Additional Tables

Table A.1: Impact of exogenous economic shocks on fertility, adding lags

	Birth rate (1)	Log births (2)
Price Index	7.739	0.165**
	(7.027)	(0.082)
Price Index, Lag	1.072	0.086
	(7.186)	(0.085)
R^2	0.148	0.968
N	24,559	24,601
Mean (s.e.) of dependent variable	14.749 (19.033)	4.145 (1.609)

Notes: Regressions include time and county fixed effects. Robust standard errors clustered at the county level in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table A.2: Impact of Price Index on total population and population by gender

	Log(population) (1)	Log(population) (2)	Fraction male (3)
Price Index	-0.028	-0.001	0.006
	(0.071)	(0.061)	(0.007)
Source	Census	CASEN	CASEN
R^2	0.994	0.995	0.528
N	24,894	2,258	2,259
Mean (s.e.) of dependent variable	8.441 (1.518)	8.720 (1.318)	0.489 (0.025)

Notes: Regressions include time and county fixed effects. Robust standard errors clustered at the county level in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table A.3: Impact of exogenous shock on number of first and non-first borns

	Log(number of first borns) (1)	Log(number of non-first borns) (2)
Price Index	0.020	0.214***
	(0.071)	(0.057)
R^2	0.957	0.965
N	24,409	24,409
Mean (s.e.) of dependent variable	3.361 (1.506)	3.698 (1.450)

Notes: Regressions include time and county fixed effects. Robust standard errors clustered at the county level in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table A.4: Impact of Price Index on employment rate and income by gender and educational attainment, CASEN

	Employment rate (1)	Labor income (2)	Subsidy income (3)	Total income (4)
	Panel A: Women with less than high school diploma			
Price Index	-0.035*	-0.134	0.453***	0.089
	(0.020)	(0.097)	(0.128)	(0.087)
R^2	0.669	0.609	0.622	0.685
N	2,259	2,259	2,253	2,259
	Panel B: Women with high school diploma			
Price Index	0.062*	-0.058	-0.026	0.155
	(0.035)	(0.112)	(0.175)	(0.117)
R^2	0.380	0.443	0.512	0.472
N	2,259	2,254	2,174	2,254
	Panel C: Women with university education			
Price Index	0.024	0.112	-0.505	0.132
	(0.071)	(0.184)	(0.437)	(0.186)
R^2	0.191	0.401	0.266	0.390
N	2,211	2,174	1,613	2,176
	Panel D: Men with less than high school diploma			
Price Index	-0.019	-0.067	0.039	-0.037
	(0.024)	(0.086)	(0.100)	(0.090)
R^2	0.676	0.674	0.805	0.655
N	2,259	2,257	2,249	2,258
	Panel E: Men with high school diploma			
Price Index	0.045	0.044	0.081	0.081
	(0.033)	(0.102)	(0.168)	(0.099)
R^2	0.469	0.526	0.412	0.532
N	2,258	2,257	2,211	2,257
	Panel F: Men with university education			
Price Index	0.073	-0.221	-0.379	-0.223
	(0.079)	(0.202)	(0.509)	(0.205)
R^2	0.226	0.435	0.283	0.432
N	2,213	2,198	1,515	2,201

Notes: Regressions include time and county fixed effects. Robust standard errors clustered at the county level in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table A.5: Impact of exogenous economic shocks: trend versus cycle

	Birth rate	Log number of births	First born	Number of children	Single mothers
	(1)	(2)	(3)	(4)	(5)
Price index	7.315	-0.153*	-0.024	0.007	-0.013
(cycle)	(7.002)	(0.087)	(0.021)	(0.052)	(0.023)
Price index	9.342	0.409***	-0.057***	0.206***	-0.049**
(trend)	(5.769)	(0.148)	(0.016)	(0.048)	(0.019)
R^2	0.145	0.967	0.122	0.256	0.629
N	24,894	24,938	24,409	24,409	24,409

Notes: Regressions include time and county fixed effects. Robust standard errors clustered at the county level in parentheses. *** p<0.01, ** p<0.05, * p<0.1