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Tax Evasion and Inflation
Evidence from the Nota Fiscal Paulista Program

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Dissertação de Mestrado

Dissertation presented to the Programa de Pós-Graduação em Economia of the Departamento de Economia, PUC-Rio as partial fulfillment of the requirements for the degree of Mestre em Economia.

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Acknowledgments

Abstract

This dissertation studies indirect effects of anti-tax evasion initiatives on consumer prices. Using the *Nota Fiscal Paulista Program* (NFP), implemented in the state of São Paulo in October 2007, I use counterfactual synthetic analysis to investigate the program's impact on 9 inflation groups. I use as potential comparison units all other states for which consumer inflation data is available. I report a significant effect of the NFP on food outside home (FOH) inflation, especially meal prices. One year after the implementation of the program, FOH prices were 5% higher in São Paulo in comparison with the synthetic counterfactual. By September 2009, FOH prices were 6.5% higher in São Paulo than in the synthetic comparison unit. These results are closely related to the evolution of the NFP in terms of distributed tax rebates and number of participants. Among the other 8 inflation groups I study, I find no significant effects on prices. Additionally, strikingly good performances of the synthetic counterfactuals among some of these groups suggest no impact at all from the program on prices (especially construction materials prices).

Keywords

Tax Evasion; Consumer Inflation; Nota Fiscal Paulista Program; Synthetic Counterfactual Analysis;

Resumo

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Essa dissertação estuda efeitos indiretos de iniciativas de combate à evasão fiscal sobre inflação ao consumidor. Usando o Programa Nota Fiscal Paulista (NFP), implementado no estado de São Paulo em Outubro de 2007, eu uso análise com contrafactual sintético para investigar os impactos do programa sobre 9 grupos de inflação. Eu utilizo os outros estados para os quais há dados disponíveis de preços ao consumidor como potenciais unidades de comparação. Eu encontro um efeito significante do NFP sobre a inflação de alimentação fora do domicílio, especialmente sobre preços de refeições. Um ano após a implementação do programa, preços de alimentação fora do domicílio haviam subido 5% a mais em São Paulo do que no contrafactual sintético. Em setembro de 2009, os preços de alimentação fora do domicílio estavam 6.5% mais altos em São Paulo, em relação ao sintético. Esses resultados estão intimamente relacionados à expansão do programa, em termos de reembolso de créditos e número de participantes. Adicionalmente, desempenhos muito satisfatórios de contrafactuais sintéticos entre outros grupos estudados sugerem que não houve impacto do programa sobre os preços desses grupos (especialmente preços de materiais de construção).

Palavras–chave

Evasão Fiscal;   Inflação ao Consumidor;   Programa Nota Fiscal Paulista;   Contrafactual Sintético;

Contents

1
Introduction

1.1
Motivation

Sizing the underground economy and causes of business non-compliance have been extensively debated in the literature[1]. Despite that, tax compliance monitoring remains a major economic concern and governments continue to seek more efficient compliance enforcement mechanisms.

Technological advances and efforts to simplify tax compliance have aided Brazilian authorities in this pursue. The federal government implemented the electronic sales receipt system (Nota Fiscal Eletrônica) in 2005, reducing compliance costs to firms and standardizing taxable revenue disclosure. Before that, in 1996, the SIMPLES system (Integrated System of Tax Payments for Micro and Small Enterprises) simplified the tax payments process and reduced the tax burden on small enterprises.

The Nota Fiscal Paulista Program (NFP) was implemented in the state of São Paulo in 2007, and represents an initiative to reduce tax evasion. For that, it relies on consumer auditing schemes.

Less attention has been devoted to indirect effects from enforcing tax compliance. Our main contribution is to start the debate of whether retailers increased prices in response to the NFP program and consequently whether the program impacted negatively consumers' purchasing power. This question has direct implication for public policy, specially as other states have followed São Paulo and implemented similar initiatives. I explore the program's implementation using synthetic counterfactual analysis.

Next section clarifies the workings of the NFP program. The following section summarizes the existing literature on the subject. Chapter 2 describes our database. Chapter 3 discusses the methodology I use to evaluate the program's impact on consumer prices. Chapter 4 lists our main results and Chapter 5 concludes.

1.2
Nota Fiscal Paulista Program

The Nota Fiscal Paulista Program (NFP) was introduced in October 2007 by the government of the state of São Paulo, aiming at giving consumers

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[1]See 1 for a comprehensive survey of this literature.

incentives to require sales tax receipts. According to the legislation, a consumer registered in the program[2] has the right to receive part of the ICMS (tax on circulation of products and services) paid by the seller, as a tax rebate.

Similar initiatives relying on consumer auditing schemes have been implemented, e.g., in the European Union and in China[3]. In the latter case, China's government has been testing tax enforcement schemes since 1998, in the form of lottery tickets linked to sales receipts[4].

Under the NFP, the tax rebate is conditional on the sales receipt related to the purchase being linked to the consumer's social security number (CPF). The government distributes as tax rebates up to 30% of the ICMS paid by a seller. From this amount, each registered consumer has the right to receive a rebate from his purchases from this seller. The rebate is limited to 7.5% of each purchase and is proportional to the size of the purchase in relation to the retailer's declared sales. Additionally, the registered sales receipts give the consumer the right to participate in monthly lotteries promoted by the government.

Consumers can file complaints about establishments whether they find irregularities concerning their receipts and establishments are subject to fines and more comprehensive audits by the authorities. The complaint system was only available since October 2008.

Retailers were the first brought into the program by the legislation, while wholesale commerce entered the NFP only in 2009. It can be argued that the NFP received extensive support from the population. In January 2008, 413 thousand people had already registered in the program. The latest available figure showed more than 15 million participants in the program. Figure A.1 (first panel) shows the evolution of the number of participants from January 2008 to October 2013.

Similarly to the number of participant's figures, the amounts in reais distributed as rebates also grew rapidly, especially during the first two years of the NFP. Figure A.1 (second panel) shows a dramatic increase in rebates from 44 thousand reais in January 2008 to an average 70 million reais distributed monthly by the end of the same year.

Importantly, the business sectors covered by the program were not included in it simultaneously. Table B.1 summarizes the entry timing when different sectors joined the NFP. Between October 2007 and May 2008, over 90 retail sales sectors entered the program. Together, they amounted to 7% of the ICMS collections in São Paulo, in 2007.

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[2]Registration is made in the Finance Department of the State of São Paulo's website.
[3]2 present a survey on similar initiatives based on consumer auditing.
[4]3

In the empirical analysis, the timespan in which I investigate prices behaviour goes from January 2005 to October 2009, due to limitations to be pointed in Chapters 3 and 4. Figure A.1 (third panel) shows the evolution of the number of participants and also of the tax rebates distributed between January 2008 and December 2009.

By the end of the 2008, the number of consumers who had joined the NFP reached 3 million people, representing over 7% of the state's population. In December 2009, participants amounted to over 7 million people.

Tax rebates presented a different growth pattern, peaking in August 2008 at almost 80 million reais, and then stabilizing until March 2009. The exponential growth in tax collections over the first 10 months since the program's inception in 2007 will be explored in the empirical analysis, being interpreted as rapidly increasing costs for tax evaders.

1.3
Literature

4 adapted the basic framework from crime economics from 5 to the problem of tax evasion. 6 extended the analysis to the framework of imperfect competition.

7 makes a comprehensive survey of tax evasion modelling. 1 summarizes the main findings about determinants and size of tax evasion in the United States. 8 adapted the framework from 9 to allow for firm heterogeneity and imperfect competition to study the size of tax evasion in Russia.

In Brazil, 10 report an increase in formality due to the SIMPLES program. 11 tested the implications of a model in which there are heterogeneity in agents' abilities and informal firms face limitation in size and financing using data for the Brazilian economy. They conclude that informal firms are smaller, less productive and employ less capital per worker. Importantly, in their model informal firms do not pay taxes at all, that is, informal firms choose to hide all they sell. The problem I study is fundamentally different from their model. I am also (or mainly) concerned about the behaviour of firms which under-reported sales before the NFP after facing the costs of compliance due to consumer monitoring.

12 found evidence of an increase of ICMS collections from the tertiary sector in São Paulo after the NFP. They use difference-in-differences estimation including other states that adopted similar programs as additional treated units.

13 evaluated the program's salience, showing that consumer closely follow the program's scheduled lotteries and reimbursement schedules. Using

establishment-level data, she also reported a gradual increase in reported revenue by retailers in comparison to wholesalers, using difference-in-differences estimation.

Another important question addressed by 13 regards firms exiting and employment responses to the NFP. This is intimately linked to the question I addressed, once tax evaders facing higher tax compliance costs should either see their profits decrease or try to share the cost with customers through price increases. She found no significant effect of the NFP on both firms exiting or employment. Based on these results, raising prices is a likely candidate response from firms, at least in sectors where they can exert pricing power.

1.4
Social Welfare and Taxation

This work is also inserted in the much broader discussion involving the relationship between social welfare and taxes.

As put in 14, the classical marginal excess burden (defined as the change in deadweight loss for an additional dollar of tax revenue) approach discussed in 15 requires the compensated elasticity, and therefore utility must be held constant. 13 uses the approach introduced in 14 for non-budget neutral policies to evaluate cost-benefit of the NFP. She discusses costs and benefits related to the NFP by estimating total participation costs and the extra tax revenue generated by the program. She performs then a simple calculation of the marginal cost of public funds and arrived at values in a range between 1.23 and 1.43 dollars per collected dollar.

I investigate whether by raising costs to non-compliant firms the NFP caused changes in relative prices and therefore impacted consumer's purchasing power. This sheds light on welfare issues from a different standpoint, in comparison to previous work.

In the perfectly competitive benchmark, raising tax costs in an industry could lead to uniform price increases and to dead weight loss. Also, in an imperfect competition set up in which firms exhibit pricing power, there could also be rising prices in response to a higher probability of punishment for evaders (see 8).

Although inconclusive for the majority of categories I study, this work contributes to the debate by showing evidence of a relative price change in response to the NFP in establishments such as restaurants. Therefore, despite the tax rebates, the welfare effect of the NFP on consumers which joined the program remains an open question and the NFP may have unambiguously affected negatively consumers which did not join the program.

2
Data

The database consists of ICMS tax collections from 2003 to 2012 for the state of São Paulo, consumer prices data for the 9 metropolitan regions and 2 cities surveyed by the IBGE (Brazilian Institute of Geography and Statistics) and also activity indicators that I will use to estimate the synthetic counterfactual for the state of São Paulo. The activity indicators comprise credit growth, monthly GDP growth, retail sales revenues and the relative size of the tertiary sector in the economy.

The following analysis evidently lacks costs indicators at the firm level. The results I find on consumer prices could be driven by costs arising from other sources rather than tax compliance costs. The reason for this is the lack of broad measures of per-state production costs, specially wages. The widest available survey on wages in formal and informal sectors (the Monthly Labor Survey from the IBGE, or PME in portuguese) comprises only 6 out of the 11 regions I include in the empirical analysis.

I choose to proceed with the analysis and leave the inclusion of costs indicators per sector (specially among sectors in which I find evidence of price increases due to the NFP) as a straightforward continuation of this work.

2.1
ICMS

I observe ICMS collections for every sector covered by the NFP from 2003 to 2012 on an annual basis, and from 2007 to 2012 on a monthly basis. I also obtained total ICMS collections data for the state of São Paulo in the period, and also breakdowns for the primary, secondary and tertiary sectors. The aggregated data can be obtained from the Brazilian Central Bank's (BCB) website, while the data by sector covered by the NFP was obtained from the Finance Department of the State of São Paulo (SEFAZ/SP) on request.

Table B.2 summarizes the characteristics of ICMS collections in São Paulo when the NFP was implemented, and also shows the nominal growth of tax collections from 2007 to 2012 as a broad measure of the program's impact [1].

The sectors covered by the NFP generated slightly less than 7% of the ICMS collections in 2007, amounting to 4.3 billion reais. Interestingly, tax

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[1] I grouped sectors covered by the NFP for better exposition. The disaggregated data is available on request.

revenues from the sectors covered by the program grew less than the average growth of the tertiary sector. This suggests that the program's impact was different among sectors, as I investigate next.

Table B.3 shows average growth in tax revenues over a five-year period before the NFP implementation (2003-2007) and between 2008 and 2012. Once again unexpectedly, growth rate of tax collections from the sectors covered by the NFP was markedly lower after the program's implementation, declining from 15.5% to 9.3% on average. Part of the decline may be explained by lower tax collections in face of weaker economic activity over the past five years, especially in 2009. Whether or not this was the case remains an open question.

Among sectors though, it is possible to highlight important changes in growth patterns. For example, among food and beverage sellers, bakeries have seen a dramatic change from an average decline of 11% per year before the NFP to over 25% growth in the subsequent years. Similar results can be seen in bars and snack bars, beverages, dairies and cold cuts, fish, restaurants and vegetables and fruits. Intuitively, this small piece of evidence suggests that the program impacted hard-to-tax markets such as food retailers.

Other sectors presented similar upward shifts in ICMS revenues growth. Important examples are house appliances and furnishings, eye and footwear, jewellery and horology, medical and orthopaedic goods and tobacco.

The NFP does not seem to have impacted ICMS collections from supermarkets, department stores, clothing, pharmaceuticals, construction materials and cosmetics, toiletries and perfumes, according to the information conveyed in Table B.3. Together, these sectors amounted to 4.43% of total ICMS revenues in 2007, or over 65% of revenues from sectors covered by the program. These findings cast doubt on the program's efficacy and help explain the similar performances in revenues growth from sectors covered by the NFP before and after the program's implementation.

2.2
Consumer Prices

I measure inflation using components from the Broad Consumer Price Index (IPCA) calculated by the IBGE. The analysis spans from January 2005 to August 2009 [2], on a monthly basis.

Inflation data is available for 9 metropolitan regions and 2 capital cities [3] There is no direct correspondence between the sectors covered by the NFP and

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[2]The choice of the period of analysis is discussed further in Chapter 3

[3]The metropolitan regions comprise Belém, Belo Horizonte, Curitiba, Fortaleza, Porto Alegre, Recife, Rio de Janeiro, São Paulo and Salvador. The cities surveyed by the IBGE are Goiânia and Brasília.

the IBGE's price survey, hence the the link between tax collections growth in a sector and the corresponding inflation data was chosen according to similarities between those databases.

Table B.4 and Table B.5 show average inflation over the 2-year period before the NFP (October 2005 to September 2007) and over the 2-year period after the program's implementation (October 2007 to September 2009), respectively. Group selection was based on both the findings regarding ICMS revenues from the previous section and also based on the group's relevance to consumer inflation. Together, the 9 groups I chose represent over 22% of the IPCA's basket [4]. They also include both sectors in which the previous analysis of ICMS collections showed changing behaviour after the program's implementation and sectors which do not seem to have been affected by the NFP according to that preliminary analysis.

Overall inflation was notably higher in the country over the latest period (monthly average of 0.43%), with all metropolitan regions facing higher average inflation in comparison to the period before the NFP.

Among the selected groups, food outside home (FOH) average inflation accelerated sharply over the period after the NFP. This group comprises restaurants, bars, bakeries and snack bars, all of them sectors in which a preliminary analysis pointed to a positive impact in ICMS collections from the NFP. The question whether inflation in São Paulo showed a different pattern in comparison to the other regions will be investigated in Chapter 4. For now, note that FOH average inflation more than doubled in São Paulo after the NFP. A similar pattern was observed only in Porto Alegre, although all other regions presented a sharp acceleration in FOH inflation.

Dairies' prices showed deflation on average over the latest period, in all regions. Footwear, clothing and eyewear inflation showed mixed results among regions. Both footwear and clothing inflation (which alone represent over 6% of the ICPA) accelerated sharply in São Paulo after the NFP. Eyewear inflation, on the other hand, decelerated slightly.

Cigarettes, meat, construction and cosmetics inflation accelerated markedly after the NFP, in almost all surveyed regions. In São Paulo specifically, all groups posted stronger increases on average in the period between October 2007 and September 2009.

2.3

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[4]The weights used are from October 2007.

Activity Indicators

I use other economic indicators to better assess the monetary conditions and growth in all regions from which I have prices data. In addition to inflation, I use credit growth and nominal revenues from the retail sales to assess monetary conditions. For growth, I use monthly economic activity indicator of the BCB (IBC-Br).

2.3.1
Credit Growth

Nominal credit balances data are provided by the BCB at the state level. Table B.6 summarizes credit conditions before and after the NFP's implementation in each state corresponding to the 11 regions from which I have inflation data.

At first glance the table exposes the difficulty to approximate credit conditions in São Paulo when the NFP was implemented. The state concentrated alone more than a third of the credit balances in the country. Regarding growth rates and despite the economic slowdown due to the financial crisis, credit growth accelerated in most states in the two-year period after the NFP's implementation. In São Paulo, credit growth remained stable on average before and after the NFP. In the 12-months period immediately prior to the program's implementation, credit growth was relatively similar among all regions, ranging from 21% in Bahia to 35% in Goiânia.

2.3.2
Nominal Revenues and Relative Size of the Tertiary Sector

IBGE surveys retail sales monthly (Monthly Commerce Survey, or PMC) at the state level. Table B.7 shows growth rates per region in nominal revenues. Growth rates were quite similar in all regions over the 12-month period prior to the NFP, raging from 6% in Goiânia to 13% in Fortaleza. Importantly, over the 2-year period after the program's implementation, retailers' revenues were markedly higher in São Paulo (the growth rate accelerated from 18% to 26%). Other regions showed mixed results, with a slight acceleration in Rio de Janeiro and a strong decline in Minas Gerais.

As in 16, I also use a qualitative measure to estimate the synthetic control for São Paulo, which is the relative size of the tertiary sector in the economy. Table B.7 also shows the relative importance of the tertiary sector in the economy of each metropolitan regions I study and also in Brasília and Goiânia, in 2006. Except for Brasília and the metropolitan region of Salvador, the tertiary sector represented between 54% and 68% of the economy in

each region. In the metropolitan region of São Paulo, it represented 61% of GDP. Brasília had the higher relative participation (83% of GDP), while the metropolitan region of Salvador had the lowest (47%).

2.3.3
GDP Growth

The last activity indicator I use is the monthly gross domestic product (GDP) proxy provided by the BCB for the whole country and at the state level. It completes the economic outlook of the analysed regions by accounting for real growth in activity.

Table B.8 shows average monthly growth rate (annualized) per state[5]. As a consequence of the 2008 financial crisis, the country suffered a sharp deceleration in real activity. Importantly, the economic slowdown was uneven among regions, with Rio de Janeiro actually facing an acceleration in average growth between the comparison periods. The average growth rate from São Paulo declined from average 5.9% before the NFP to 4.0% over the 2-year period after the program's implementation, a relatively smooth slowdown in comparison to the country's average.

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[5]The BCB does not calculate the activity indicator for Brasília. The regions selected for the empirical analysis will be discussed further in Chapters 3 and 4

3
Methodology

I follow 16, 17 and 18 and use synthetic control methods to evaluate the indirect impacts of the NFP's implementation on consumer prices in the state of São Paulo. The outcome variables are the accumulated inflation rates from January 2005 to September 2009[1], for groups selected according to the previous analysis of ICMS collections growth in the period. The sizes of the pre-treatment periods for each inflation group will depend on their entry date in the NFP.

Synthetic control is a data-driven procedure in which quantifiable characteristics (both quantitative and qualitative) are used to create a comparison unit as a weighted average of potential comparison units (see Abadie *et al* (2012)). In this sense, one advantage of the method is transparency in regard to the control selection. I simply gather all the available data related to the problem I study in order to create the best synthetic counterfactual, in a sense to be clarified in the following section.

I use all metropolitan regions for which inflation data is available and also the city of Goiânia as potential comparison units for the state of São Paulo. Brasília adopts a similar tax rebate program since June 2008, the *Nota Legal*, therefore it was removed from the donor pool. I also restrain the analysis from January 2005 to September 2009 because of the adoption of a similar tax rebate program in Rio de Janeiro in October 2009, the *Cupom Mania*. In summary, the analysis extends from January 2005 to September 2009 and I keep eight metropolitan regions and Goiânia in the donor pool. The exclusion of other regions that adopted similar programs exempts a discussion of interference between units (19), especially for non-tradable goods (for example, a restaurant raising prices in São Paulo should not be expected to affect prices charged by restaurants in Belo Horizonte).

Given the small sizes of both the treatment and control groups, as well as the small number of policy changes, I believe synthetic control is the appropriate method for making inference about the NFP's effects on prices. 20 addresses the problems of traditional difference-in-differences inference methods when the number of treated and control units is small. 21 deals with the problem of difference-in-differences when there is a small number of policy changes, and 22 examine inference using difference-in-differences when

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[1]December 2004 was based as 100 and inflation was accumulated multiplicatively since then.

the number of groups is small. Following 17, I perform inferential exercises that can give informative inference regardless of the number of available comparison units.

3.1
Synthetic Control

Let J be the number of available control units and a vector $\mathbf{W}$ of weights which sum to one. Each entry of the vector $\mathbf{W}$ represents the weight of region j in the synthetic São Paulo. The weights are chosen so that the synthetic comparison unit most closely resembles São Paulo before the NFP by choosing $W^\star$ that minimizes:

$$(X_1 - X_0 W)'V(X_1 - X_0 W) \tag{3-1}$$

subject to $w_j \geq 0$ $(j = 1, 2, ..., J)$ and $w_1 + w_2 + w_3 + ... + w_J = 1$.

The vector $\mathbf{X_1}$ and the matrix $\mathbf{X_0}$ contain predictors of the outcome variable (in our case, consumer inflation) for the treated unit and for the potential comparison units. As outlined in Chapter 2, the inflation predictors I include in $\mathbf{X_1}$ and $\mathbf{X_0}$ are: credit and nominal revenues growth over the 12 months period before the program's implementation, the size of the tertiary sector in the economy (based on the official GDP from 2006) and average monthly GDP growth over a 10-12 months window before the NFP[2]. Following 17, these variables are augmented by adding past values of the outcome variable. I add accumulated inflation over whole the pre-treatment period and accumulated inflation over the 12 months period before the NFP to $\mathbf{X_1}$ and to $\mathbf{X_0}$.

The matrix $\mathbf{V}$ is chosen in order to minimize the distance between the outcome variable (consumer inflation) from the synthetic and from São Paulo over the pretreatment period.

3.2
Properties of the Estimator

Following Abadie *et al* (2010), let Y_{it}^N be the outcome that would be observed for the metropolitan region i at time t in the absence of the NFP $(i = 1, ... J+1, t = 1, ..., T)$. Also let T_0 be the number of pretreatment periods, with $1 \leq T_0 < T$. Lastly, let Y_{it}^I be the outcome that would be observed for unit i at time t if unit i is exposed to the treatment in periods $T_0 + 1$ to T. Importantly, I assume that consumer prices were not impacted by the

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[2]Some of the analyses were sensitive to the GDP growth window I choose. This point is still to be investigated in future work.

intervention before its beginning, that is, in the problem I study I assume that firms did not set higher prices in anticipation to the NFP.

In this framework $\alpha_{it} = Y_{it}^I - Y_{it}^N$ is the treatment effect (the effect of the NFP on the level of prices, in this study). Suppose, without loss of generality, that the unit $j = 1$ is the treated unit. I aim to estimate $(\alpha_{1T_0+1}, \alpha_{1T_0+2}, ..., \alpha_{1T})$. Because Y_{1t}^I is observed, to estimate α_{1t} I need to estimate Y_{1t}^N.

To illustrate the statistical properties of the estimator, suppose the following model with time varying coefficients:

$$Y_{it+1}^N = \alpha_t Y_{it}^N + \beta_{\mathbf{t+1}}\mathbf{Z_{it+1}} + u_{it+1} \tag{3-2}$$

$$\mathbf{Z_{it+1}} = \gamma_t Y_{it}^N + \mathbf{\Pi_t Z_{it}} + \mathbf{v}_{it+1} \tag{3-3}$$

where u_{it+1} and $\mathbf{v}_{it+1}$ have mean zero conditional on $F_t = \{Y_{js}, \mathbf{Z}_{js}\}_{1 \leq j \leq N, s \leq t}$.

Also suppose that I can choose $\{w_j^\star\}_{2 \leq j \leq N}$ such that:

$$\sum_{j=2}^J w_j^\star Y_{jT_0} = Y_{1T_0} \ and \ \sum_{j=2}^J w_j^\star \mathbf{Z_{jT_0}} = \mathbf{Z_{1T_0}} \tag{3-4}$$

Substituting (4-3) in (4-2) at $t = T_0$ I obtain:

$$Y_{iT_0+1}^N = (\alpha_{T_0} + \beta_{\mathbf{T_0+1}}\gamma_{T_0})Y_{iT_0}^N + \beta_{\mathbf{T_0+1}}\mathbf{\Pi_{T_0}Z_{iT_0}} + \beta_{\mathbf{T_0+1}}\mathbf{v_{iT_0+1}} + u_{iT_0+1} \tag{3-5}$$

Iterating one step forward I obtain:

$$Y_{iT_0+2}^N = A_{T_0+2}Y_{iT_0}^N + B_{T_0+2}\mathbf{Z_{iT_0}} + C_{T_0+2}\mathbf{v_{iT_0+1}} + D_{T_0+2}u_{iT_0+1} + \beta_{\mathbf{T_0+1}}\mathbf{v_{iT_0+2}} + u_{iT_0+2}{}^3$$
$$\tag{3-6}$$

Proceeding iteratively, I find that, conditional on Y_{iT_0} and Z_{iT_0}, $Y_{iT_0+n}^N$ is function (linear) of $\{u_{it}, \mathbf{v_{it}}\}_{T_0+1 \leq t \leq T_0+n}$. Once $\{w_j^\star\}_{2 \leq j \leq N}$ is a deterministic function of F_{T_0} and $\{u_{it}, \mathbf{v}_{it+1}\}_{T_0+1 \leq t \leq T_0+n}$ have mean zero conditional on F_{T_0}, the bias of the synthetic control estimator is equal to zero if Equation (3-4) holds.

3.3
Inference

As argued earlier in this section, making inference when the number of comparison units is small represents a big challenge in comparative case studies. I follow 17 and 18 and perform placebo studies to quantitatively evaluate the significance of the empirical results.

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[3]Where $A_{T_0+2} = (\alpha_{T_0+1} + \beta_{\mathbf{T_0+2}}\gamma_{T_0+1})(\alpha_{T_0} + \beta_{\mathbf{T_0+1}}\gamma_{T_0}) + \beta_{\mathbf{T_0+2}}\mathbf{\Pi_{T_0+1}\Pi_{T_0}}$, $B_{T_0+2} = (\alpha_{T_0+1} + \beta_{\mathbf{T_0+2}}\gamma_{T_0+1})(\beta_{\mathbf{T_0+1}}\mathbf{\Pi_{T_0}}) + \beta_{\mathbf{T_0+2}}\mathbf{\Pi_{T_0+1}\Pi_{T_0}}$, $C_{T_0+2} = (\alpha_{T_0+1} + \beta_{\mathbf{T_0+2}}\gamma_{T_0+1})\beta_{\mathbf{T_0+1}} + \beta_{\mathbf{T_0+2}}\mathbf{\Pi_{T_0+1}}$ and $D_{T_0+2} = \alpha_{T_0+1} + \beta_{\mathbf{T_0+2}}\gamma_{T_0+1}$.

I randomize the assignment to the intervention and perform synthetic control analysis for all metropolitan regions and for the city of Goiânia, removing São Paulo from the donor pool. This allows me to investigate how the estimated effect of the intervention on São Paulo compares to the estimated effect on another region chosen at random. This is informative inference under the assumption that, under the hypothesis of no intervention effect, the estimated effect on the treated unit should not be abnormal relative to the placebo effects.

3.4
Further Issues

Reproducing the state of São Paulo is a major task. It is the richest Brazilian state, representing over a third of the Brazilian GDP in 2013[4]. As I put it in Chapter 2, the state concentrated more than a third of credit balances back in 2007, being also the country's financial center. It would then be very hard to demonstrate the validity of Equation (3-4).

Despite these difficulties, the performance of a synthetic counterfactual over the pre-treatment period may signal a good representation of the state's characteristics, at least when I analyse specific sectors. The lack of costs measures as inflation predictors also casts doubt on the results I obtain, and should therefore be addressed in future work.

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[4]See www.ibge.gov.br for national account statistics.

4
Main Results

This chapter presents the empirical findings obtained from the synthetic control analyses applied to 9 inflation groups. I only obtained a statistically significant effect from the NFP implementation on prices for food outside home inflation. Therefore, I make full assessment of the results for this group and only present partially the results obtained for the other groups.

4.1
Food Outside Home

4.1.1
Results

Food-outside-home inflation represented more than 7% of the IPCA basket in 2007. Figure A.2 (first panel) shows the evolution of food outside home prices in São Paulo as well as the behaviour of the synthetic counterfactual between January 2005 and September 2009 (December 2004 = 100). As noted in Chapter 2, restaurants were included in the NFP in October 2007. Hence, for this group the pre-treatment period extends from January 2005 to September 2007.

The optimal weights (and metropolitan regions) which compound the synthetic São Paulo are: 40% (Belo Horizonte), 27% (Recife), 19% (Goiânia) and 14% (Porto Alegre).

Table B.9 contains the comparative statistics between São Paulo and the synthetic. The synthetic approximated well the accumulated inflation over the pre-treatment period, the accumulated inflation over the 12 months prior to the program's implementation and credit growth over this shorter period. The qualitative variable included in the analysis, the size of the tertiary sector in São Paulo, was also closely approximated by the synthetic counterfactual, though the sample average would be even closer. Our monthly GDP indicator was poorly approximated by the synthetic over the pre-treatment period, with São Paulo showing a considerably larger growth on average. Growth in nominal revenues also was relatively well approximated, but again the sample average was closer to the observed growth in São Paulo.

Notably, the performance of the synthetic counterfactual was similar over the pre-treatment period and over the period between October 2007 and June 2008 (Figure A.2, second panel). During both periods, the mean squared error

(MSQE) of the synthetic was around 0.92%. This suggests that the synthetic counterfactual indeed captured consumer prices dynamics before the NFP achieved a relatively large number of participants.

Figure A.2 (third panel) depicts the differences between the synthetic counterfactual and actual accumulated inflation in São Paulo[1] from January 2008 to September 2009. It also depicts the evolution of tax rebates from the NFP program in the same period. The similar evolution of these variables in 2008 is striking. Tax rebates peaked in August 2008 at over 80 million reais, rising sharply from 20 million in June, and remained relatively stable until February 2009. The error of the synthetic peaked two months later, in October 2008 at almost 5%, also a sharp increase from 1% in June. Tax rebates behaviour was volatile over 2009, ranging from 60 million to 110 million reais per month. The error of the synthetic counterfactual, on the other hand increased steadily during the year, reaching over 7.5% in August and declining to around 6.5% in September.

Despite being more volatile and subject to seasonality issues, the series of ICMS collections from restaurants also showed a similar pattern between March 2008 and September 2008 (Figure A.3, first panel). After a spike in January 2008 of almost 7 million reais in collections, the monthly figure increased from 4.4 million reais in March to an average 5.9 million reais between June and September (a 34% increase). In comparison to the previous year, ICMS collections from restaurants had increased 16.5% in March 2008. By September 2008, growth had accelerated to 40% in nominal terms. After another spike in December 2008, monthly collections remained relatively stable at around 6 million reais until the end of the period of analysis.

ICMS collections from bakeries only started showing a markedly different trend in collections from November 2008 on (Figure A.3, second panel). Over the first semester of 2008, there is no clear evidence of a significant increase in collections in the period between March and September 2008. In fact, between August 2008 and October 2008 monthly collections increased 22%. After declining in November 2008, collections from bakeries increased continuously until June 2009, reaching 73% growth in comparison to June 2008.

In this subsection I showed evidence supporting the thesis that the poor performance of the synthetic counterfactual after June 2008 is strongly related to the NFP program (especially until September 2008). The next subsection investigates whether this relationship has also statistical significance.

4.1.2

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[1]The 'error' is defined as 'actual minus synthetic'.

Inference

I evaluate the significance of the deviation of the counterfactual from actual inflation by constructing placebos for the other surveyed regions (Figure A.4, first panel). In comparison to São Paulo (black line), some placebos showed a similar pattern, with errors becoming positive and significantly higher over the post-treatment period, in comparison to the pre-treatment period.

Figure A.4 (second panel) depicts the ratio between the MSQE of the post-treatment period and the MSQE of the pre-treatment period, for all regions. São Paulo (black dot) showed an average squared error almost 20 times higher after the NFP in comparison to the period before the program. It was the highest ratio among the 10 regions. In the same spirit as 17, if one were to assign the intervention at random in the data, the probability of obtaining a MSQE ratio as large as São Paulo's is $1/10 = 10\%$, a significance level often used to describe results as 'marginally significant'[2].

Figure A.4 (third panel) compares the performances of the synthetic counterfactuals from São Paulo, Belo Horizonte and Rio de Janeiro, the main capital cities from Brazil's South-East Region. While the counterfactuals from Rio de Janeiro and Belo Horizonte perform similarly before and after the treatment, São Paulo's synthetic counterfactual performs notably poorer after June 2008.

Lastly, to further assess the significance of the FOH result, I follow 18 and perform an "in-time placebo" test for food outside home inflation in São Paulo. I divide the pre-treatment period in two equally long parts and observe the post treatment behaviour of the synthetic (Figure A.5).

A poor performance of the synthetic counterfactual before the implementation of the NFP would cast doubts on the validity of the previous findings, once I do not identify a structural shock as important as the NFP which could cause inflation trends to significantly change before October 2007. Despite the poor performance of the synthetic counterfactual over the pre-treatment period in the in-time placebo analysis (January 2005 to April 2006), food outside home inflation was fairly well approximated by the synthetic counterfactual between May 2006 and September 2007. This reinforces the significance of the results reported in the previous subsection.

4.1.3

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[2]Notice that the inclusion of Rio de Janeiro in the sample is mandatory for me to discuss significance in the terms of 17, and hence I chose to exclude Brasília from the donor pool but limit the period of analysis in order to maintain Rio de Janeiro in it.

Meals

It could be argued that, among the groups that compose food outside home inflation, groups not likely to be impacted by the NFP could be behind the acceleration in inflation I just reported.

Meals represented over 50% of the food outside home basket from the IPCA in 2007. Figure A.6 (first panel) shows the results of the synthetic counterfactual estimation for meals inflation. Despite the poorer performance of the synthetic over the pre-treatment period in comparison to the result for the aggregate group (reflected in a higher MSQE), the pattern is very similar. The error of the synthetic peaked in October 2008 at 7% and, after decreasing to 5% by the end of 2008, reached 13% in August 2009. In September 2009, the error declined to 10%.

Inference exercises also show statistical significance of these results, with the MSQE ratio for São Paulo being again the highest among the regions studied (Figure A.6, second and third panels).

4.1.4
Hard-to-tax Markets

The results showed in this section are closely related to the hard-to-tax (HTT) markets literature[3]. HTT markets are identified as small and medium-size taxpayers or firms. Restaurants are mostly small businesses in which money transactions are common. In 2011, 61% of the firms in the services sector (excluding financial services) were engaged in food services. This exemplifies the extento to which monitoring tax compliance in the sector is both a hard task and is also of critical importance.

The NFP relies on consumer auditing to mitigate costs related to compliance monitoring. This section showed that, in a close relationship to the expansion of the NFP program, food establishments increased prices. I argue that those price increases were in response to higher tax payment costs.

4.2
Contruction Materials

Construction materials joined the NFP in February 2008. The group comprises house repair materials, electricity materials, wall paint, tools and also construction services. It represented around 0.5% of total ICMS collections in São Paulo in 2007, and alone accounted for over 7% of ICMS collections from sectors included in the NFP.

[3]See 2.

The synthetic's performance tracking São Paulo's inflation is this group is remarkable (Figure A.7, first and second panels). Again, Belo Horizonte represented 50% of the synthetic comparison unit (Goiânia represented 44% and Recife 6%). By the end of 2009, accumulated inflation in São Paulo was only 2% lower in comparison to the synthetic counterfactual. Also, the mean absolute error of the synthetic over the post-treatment period was only 0.6%.

The MSQE over the post-treatment period in São Paulo was the smallest among all regions, in comparison to the error over the pre-treatment period (Figure A.7, third panel).

These findings are in accordance with the preliminary evidence that shows no important change in ICMS collections growth rate from construction materials retailers after the program's implementation (Table B.3).

Also, they reinforce our findings from FOH inflation. As argued, the lack of costs indicators at the firm level jeopardizes the validity of our findings and should guide future research on the subject. Nevertheless, the strikingly good performance of the synthetic presented in this section suggests no divergent cost increases in São Paulo right after the NFP's implementation, in comparison to the comparison units which compound the synthetic. It suggests that, whether there were cost increases which caused (at least partly) the divergence in FOH prices, they did not come from basic wages or rental costs but from specific costs from FOH establishments (for example, from wholesale agricultural prices).

4.3
Meat

Meat alone represented over 2% of the IPCA basket in 2007, justifying the group's inclusion in the analysis.

Figure A.8 (first and second panels) describes the results obtained by the synthetic counterfactual analysis applied to meat inflation and the placebos for the group. The synthetic performs quite well in reproducing inflation in São Paulo during the post-treatment period. The synthetic performed poorly during 2009, only distancing from actual inflation almost a whole year after joining the NFP (meat products joined the NFP in April 2008).

As seen in Chapter 3, meat inflation accelerated significantly in the country over the two-year period after the program's start. Despite that, the good performance of the synthetic all over 2008 and the relatively low MSQE ratio for the group make this result not statistically significant (Figure A.8, third panel).

Again, the good performance of the synthetic counterfactual (1.4%

average absolute error between April 2008 and December 2008) reinforces the results supported by the FOH analysis. This time, it does not only suggest no significant divergence of basic costs in São Paulo in comparison to the comparison units[4] but also partially accounts for input costs in FOH establishments, giving further support to the results described previously.

4.4
Other Results

4.4.1
Cigarettes

The results for cigarettes inflation are showed in Figure A.9. The tobacco industry in Brazil was (and still is) concentrated when the NFP was implemented, with Souza Cruz S.A. controlling over 75% of the market in 2008 and 2009[5]. As a consequence, many regions in the country share similar pricing policies by the company and therefore prices should be highly correlated.

Cigarettes joined the NFP in May 2008. São Paulo's synthetic tracks closely cigarettes inflation in the state until May 2009, when a 6% gap appears. The inferential analysis (Figure A.9, third panel) shows that this result is also statistically significant at the 10% level. Nevertheless, this result is not related to the NFP, but to the governmental counter-cyclical policies after the 2008 financial crisis.

In May 2009, in order to alleviate the effects on fiscal revenues of many tax exemptions implemented to curb the effects of the economic deceleration in face of the 2008 crisis, the Brazilian government increased by over 30% the Tax on Industrialized Products (IPI) on cigarettes[6]. The synthetic counterfactual analysis shows that the pass-through from the measure to prices was milder in São Paulo, in comparison to the regions that compound the synthetic (namely, Curitiba (69%), Recife (16%) and Belém (15%)).

4.4.2
Clothing

Clothing entered the NFP in May 2008. The group represented 4.4% of the IPCA basket in 2007 and also accounted for 1% of total ICMS collections in São Paulo in that year.

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[4]The weights from the meat inflation synthetic comparison unit are: Belo Horizonte 42%, Recife 35%, Belém 22% and Fortaleza 1%.

[5]See http://www.souzacruz.com.br/ for further information.

[6]See http://www.receita.fazenda.gov.br/ for reference about the IPI tax on cigarettes.

I found no evidence suggesting that the NFP impacted clothing prices. Figure A.10 (first and second panels) shows the synthetic counterfactual inflation in comparison to actual inflation and the placebos errors, respectively.

São Paulo's synthetic performed similarly well before and after the sector entered the program, as showed by the relatively low MSQE ratio (Figure A.10, third panel).

4.4.3
Dairies

Dairies inflation and the path of the synthetic counterfactual are depicted in Figure A.11 (first panel). They accounted for 2.1% of the IPCA bastket in 2007 and, as showed in Table B.3, ICMS collections from this sector reverted a declining trend after joining the NFP.

Average inflation in this sector became negative over the 2-year period after the NFP's implementation (Tables B.4 and B.5). The synthetic counterfactual analysis shows that in São Paulo the relative deceleration in prices was milder than in the regions with positive weights in the synthetic counterfactual (Belo Horizonte (68%), Porto Alegre (30%) and Recife (2%).

Although prices were over 8% higher by the end of the post-treatment period in São Paulo in comparison to the synthetic counterfactual, the results are not statistically significant (Figure A.11, second and third panels).

4.4.4
Eyewear

I also did not find evidence of a significant impact of the NFP on eyewear prices (Figures A.12). The synthetic performs relatively well both in the pre-treatment and in the post-treatment periods, with almost the same accumulated inflation in the period of analysis (40.9% in São Paulo and 41.9% in the synthetic counterfactual).

Therefore, despite the sharp acceleration in ICMS collections growth after the NFP (Table B.3), there does not seem to be a significant impact from the NFP on eyewear prices.

4.4.5
Footwear

ICMS collections from footwear also accelerated markedly after the sector joined the NFP in May 2008 (Table B.3). Despite that, the synthetic counterfactual analysis did not show a significant impact on prices from the

its inclusion in the NFP (Figure A.13, first and second panels). The group represented 1.8% of the IPCA basket in 2007.

Notably, the performance of the counterfactual over the pre-treatment period was poor in comparison to other results (2.5% MSQE in the pre-treatment period against 0.92% from food outside home). This resulted in the lowest MSQE ratio among all regions (Figure A.13, third panel).

4.4.6
Personal Hygiene

Lastly, I investigate whether personal hygiene inflation was impacted by the NFP. The group comprises hair and skin products, deodorants, soap and perfumes. It accounted for 2.3% of the IPCA basket in 2007. Figure A.14 (first panel) shows the performance of the synthetic counterfactual in comparison to actual inflation.

Similarly to the food outside home case, the error of the synthetic increased from 0.0% to 4.7% between April 2008 and September 2008. Importantly, actual inflation turned higher in São Paulo right after the program entered the NFP, when the NFP had already 2 million participants.

Despite the similarities to the FOH case, the poor performance of the synthetic São Paulo over the pre-treatment period (until April 2008) lowered the MSQE Ratio for this sector (Figure A.14, second and third panels). I found no statistically significant relationship between the introduction of the NFP and prices from personal hygiene products.

5
Conclusion

Following evidence that firms exiting and employment were not significantly impacted by the NFP (13), I performed an extensive investigation of whether firms increased prices to share rising tax compliance costs with customers.

I found evidence of a significant increase in prices of food outside home (FOH) over the same period in which tax rebates from the NFP sharply increased. Accumulated FOH inflation in October 2008 was 5% higher in São Paulo in comparison to its synthetic counterfactual. By September 2009, the error of the synthetic counterfactual was at 6.5%. These results are significant at the 10% level and the in-time placebo analysis reinforced the significance.

I showed that meal's inflation was responsible for this result. Meals prices increased 7% more in São Paulo in comparison to its synthetic counterfactual until October 2008, and had increased 10% more than in the synthetic counterfactual in September 2009. This result is also statistically significant at the 10% level.

There is still need to assess how costs in FOH-related firms (restaurants, bakeries, snack bars and bars) behaved over the same period. We could use rental costs, wholesale food prices and wages proxies for these firms' costs to investigate whether costs other than higher tax compliance might have impacted prices in São Paulo over the post-treatment period. The analyses performed in other inflation groups, however, suggest that these effects might not have been of critical importance to the determine the behaviour I reported for FOH prices.

Consumer inflation in sectors such as construction materials and meat was fairly well described by their corresponding synthetic counterfactuals. This suggests that basic costs among retailers (e.g., base wages and rental costs) might not have been significantly divergent in São Paulo by the time the NFP was implemented, in comparison to the other regions of the country. Also, the fact that the synthetic counterfactual for meat inflation approximated fairly well inflation in this group partly controls for possible effects of inputs prices in the results I report for FOH inflation.

I found no evidence of impacts from the NFP on prices among the other 6 groups I analysed. Although the synthetic counterfactual analysis pointed to a marginally significant effect of the NFP on FOH prices, it should be emphasized that this still consists in very preliminary results for the question of whether

NFP impacted relative prices. The use of aggregated data makes it extremely difficult to identify the exact causes of the change in relative prices I observe and the lack of sectoral cost indicators casts doubt even on the analysis using aggregated data.

Putting those issues aside, the results I obtained have straightforward implications for public policy. They shed light on a possible trade-off faced by the tax authorities between improving tax collections and impacting consumer's cost of living. This possible trade-off becomes even more important as evidence points to a more pronounced effect on FOH establishments. The framework used in this dissertation could also be applied to study similar initiatives inspired by the NFP and implemented in other states (e.g., similar programs implemented in Rio de Janeiro and in Brasília).

6
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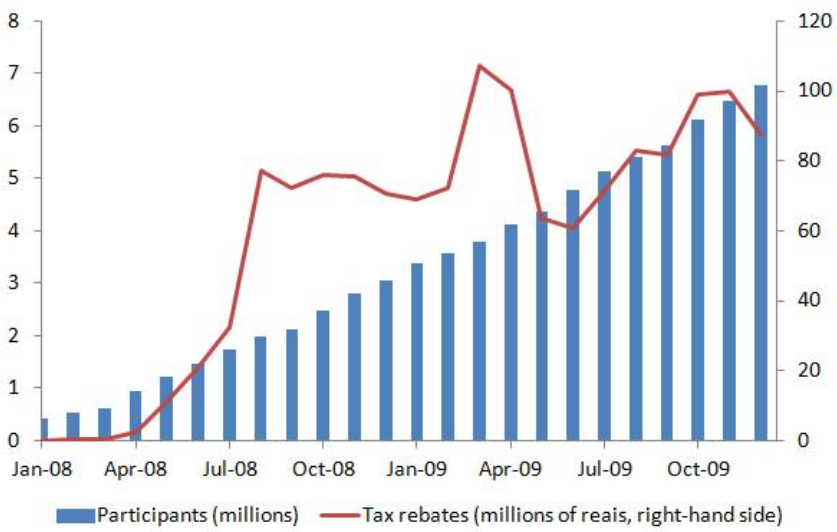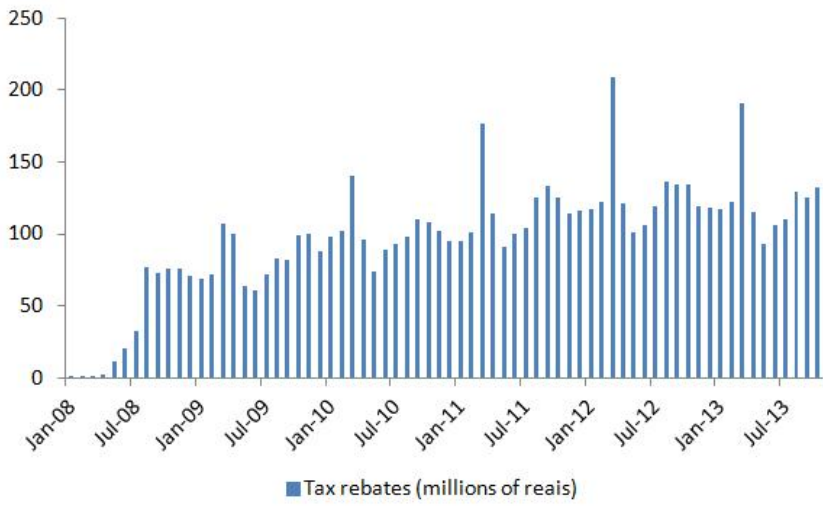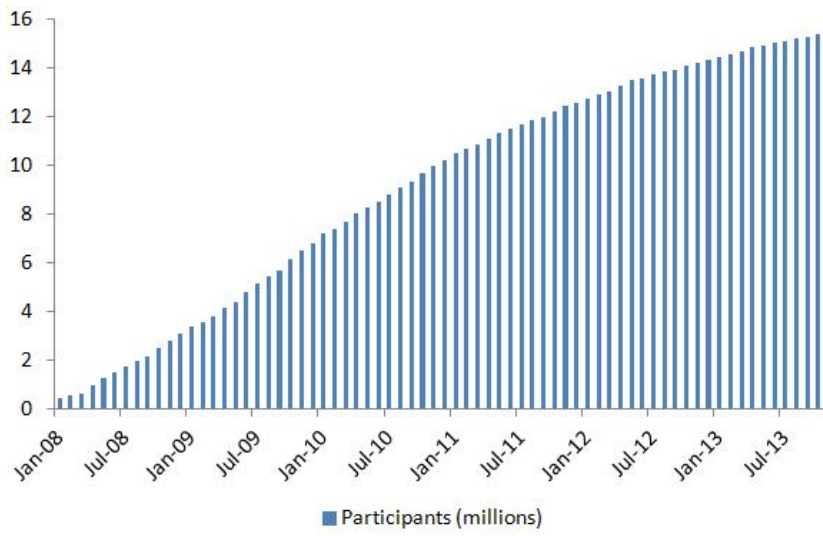
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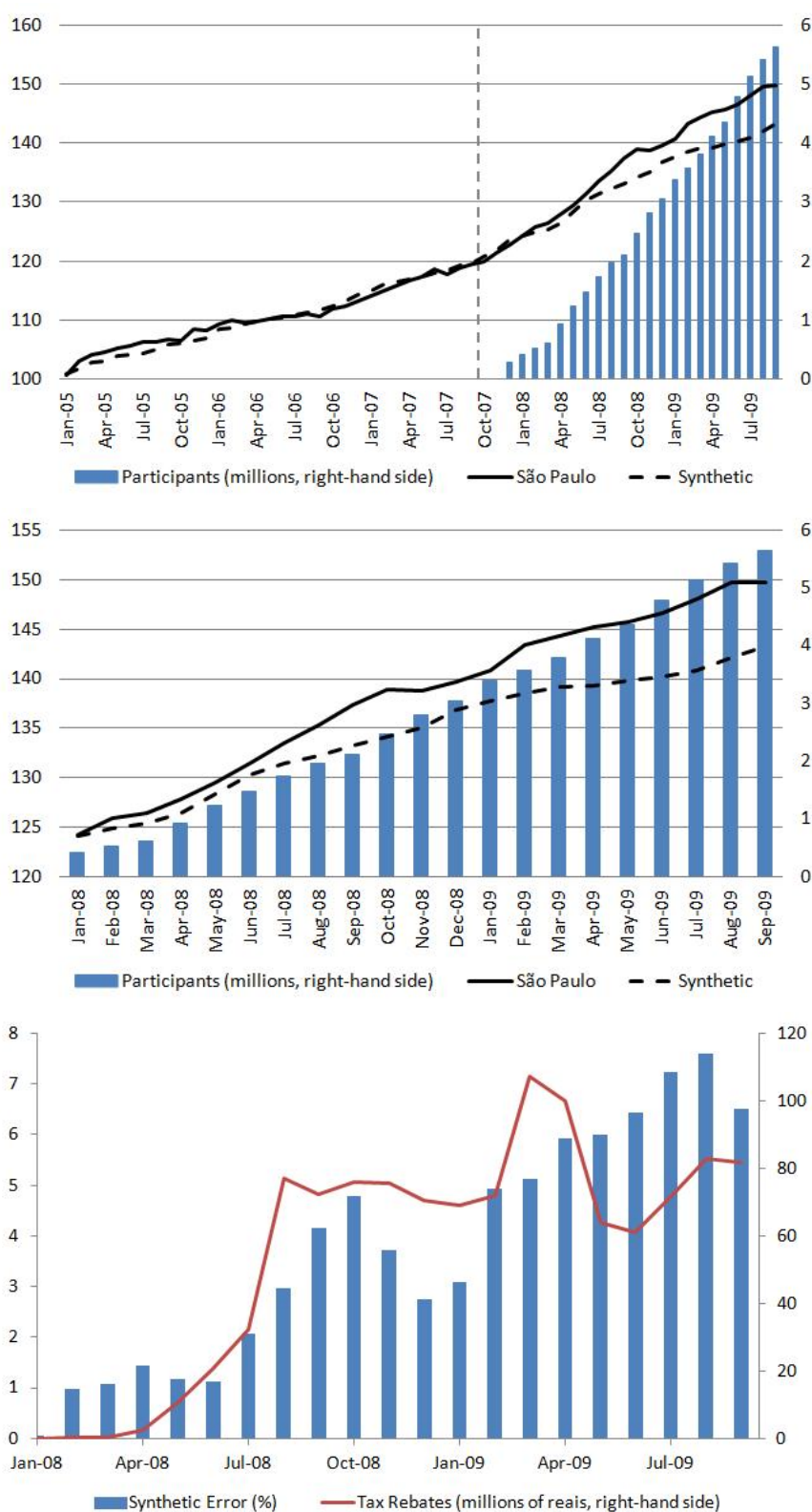
A
Figures

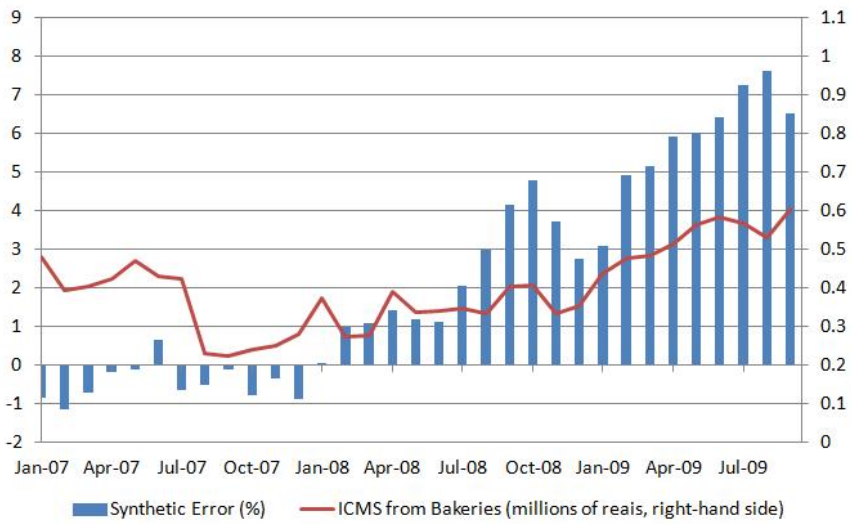FIGURE A.1: Nota Fiscal Paulista Program

Source: SEFAZ/SP

FIGURE A.2: Food Outside Home Inflation

Source: SEFAZ/SP

FIGURE A.3: ICMS collections from Restaurants and Bakeries
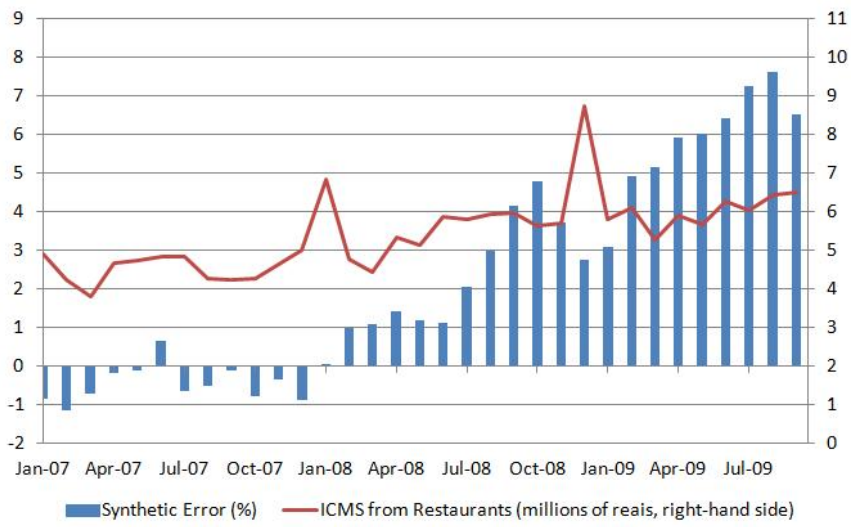
Source: SEFAZ/SP

FIGURE A.4: FOH Inflation - Inference
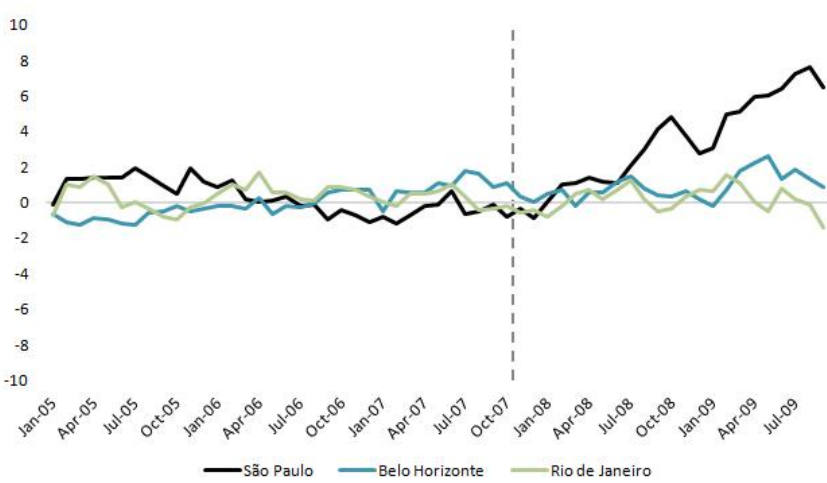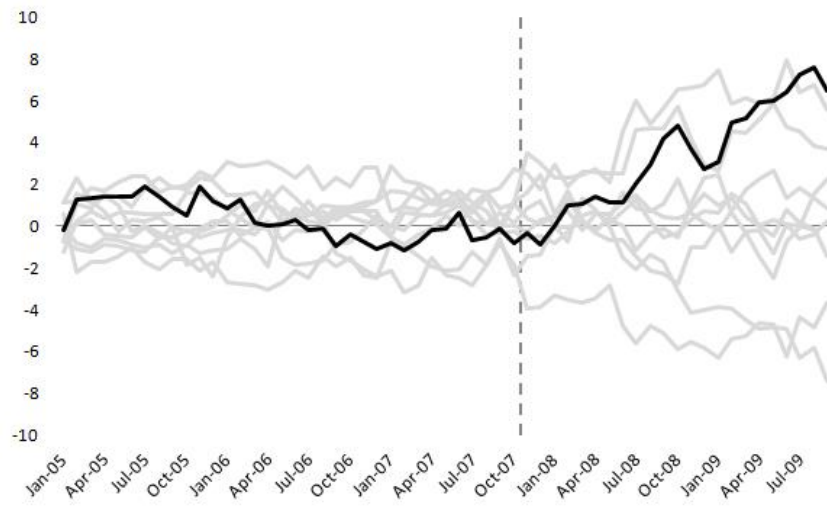
FIGURE A.5: FOH Inflation - In-Time Placebo

FIGURE A.6: Meal Inflation

FIGURE A.7: Construction Materials Inflation

FIGURE A.8: Meat Inflation

FIGURE A.9: Cigarette Inflation
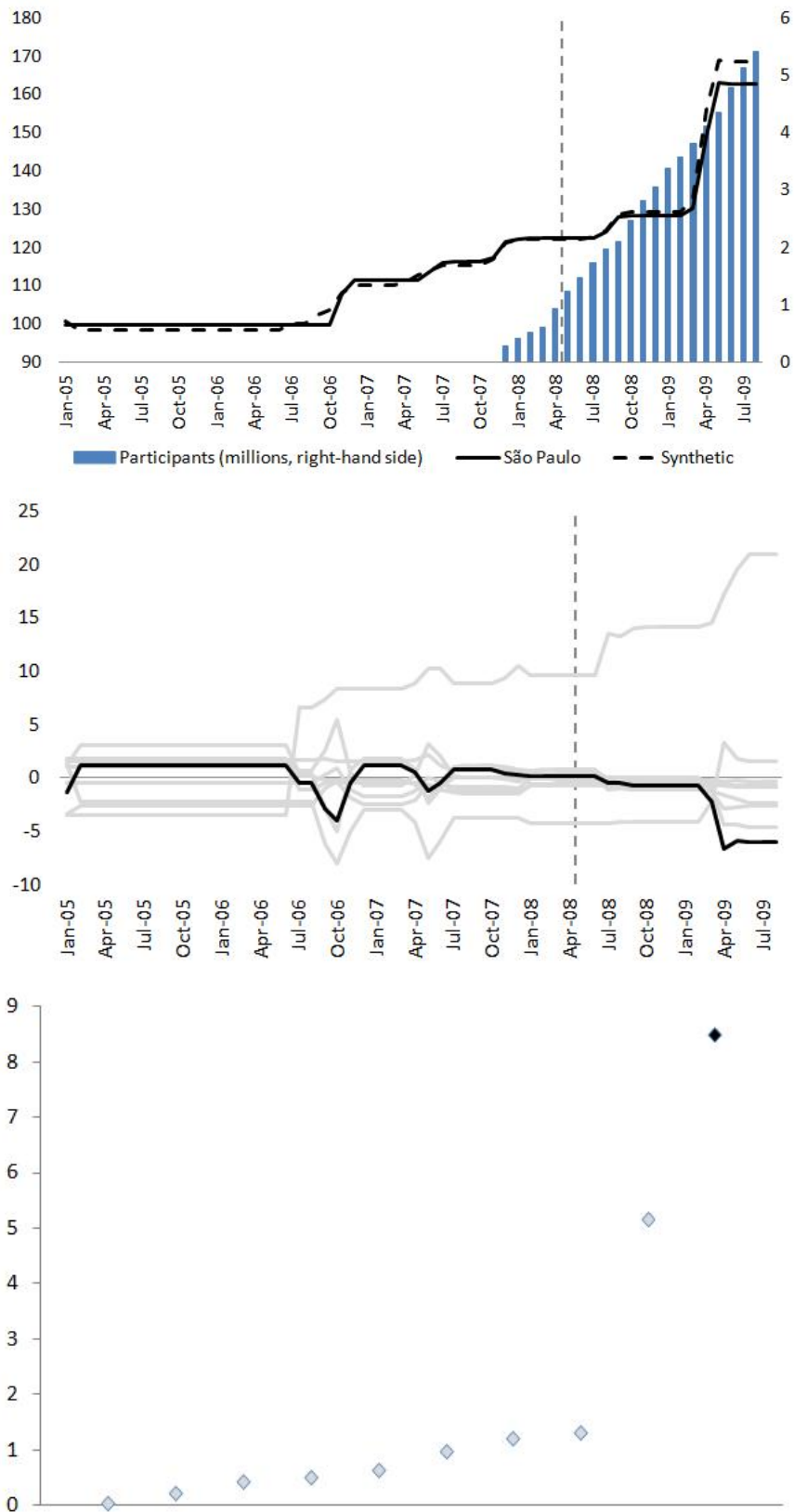
FIGURE A.10: Clothing Inflation
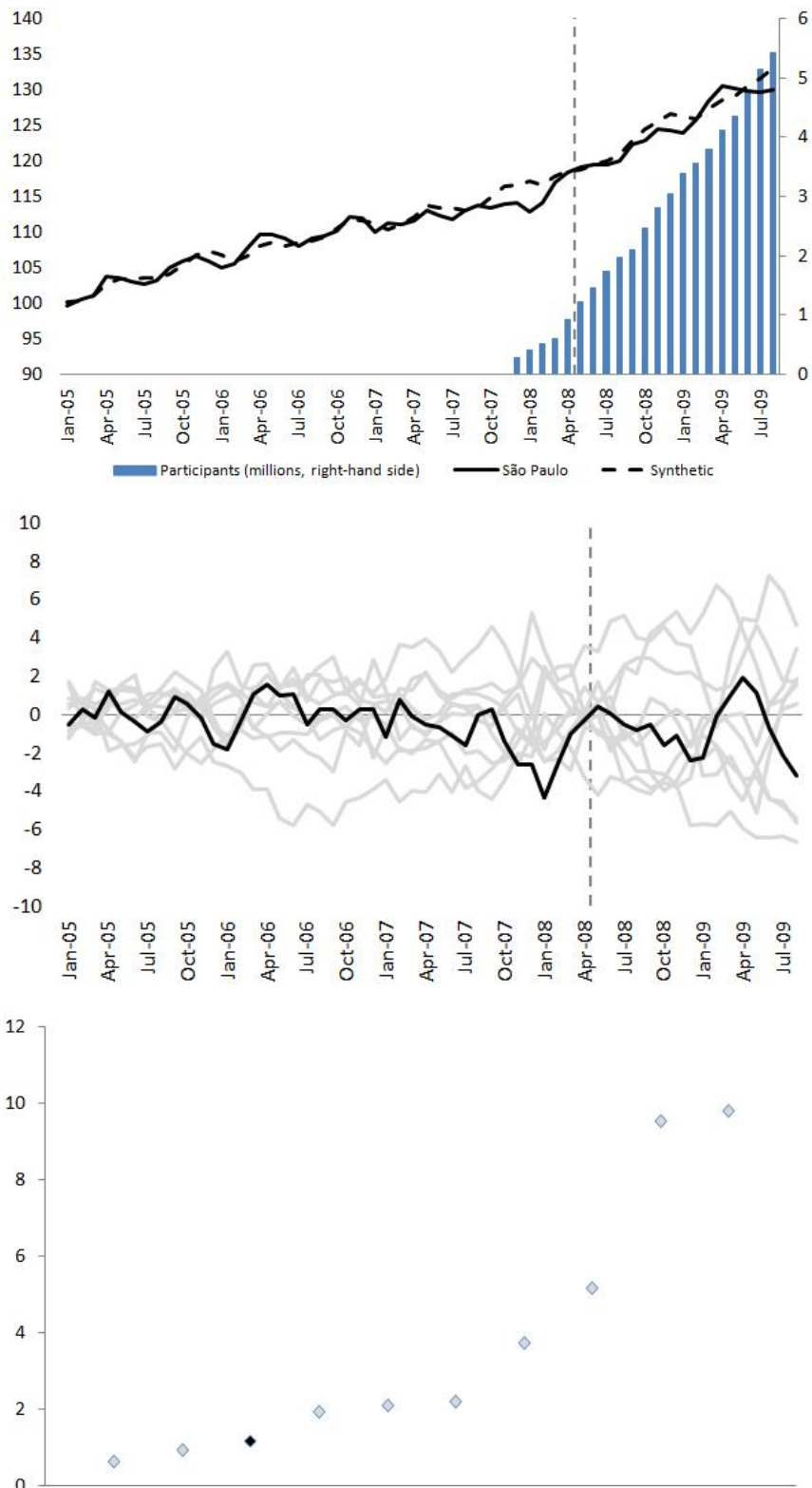
FIGURE A.11: Dairies Inflation
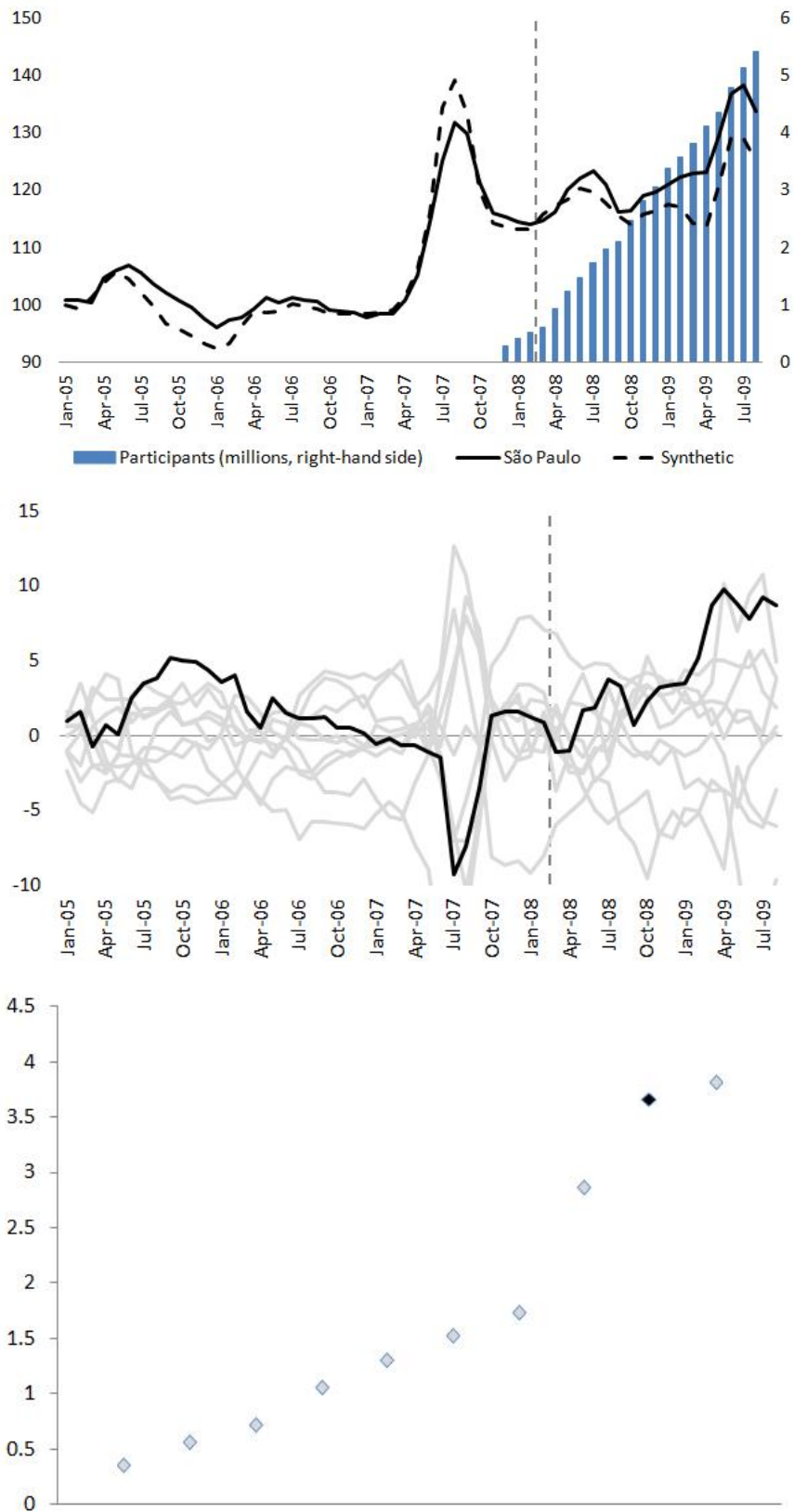
FIGURE A.12: Eyewear Inflation
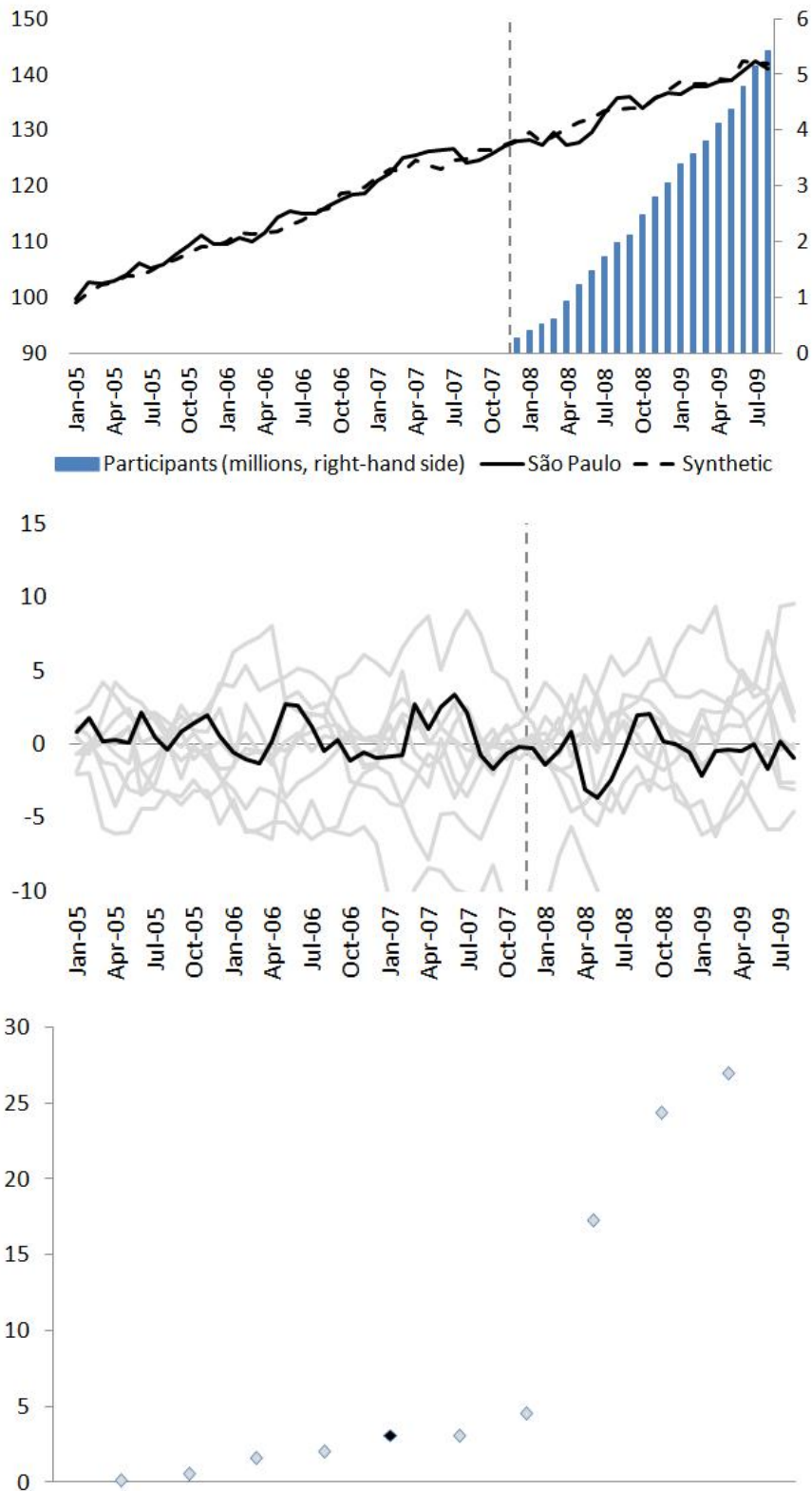
FIGURE A.13: Footwear Inflation
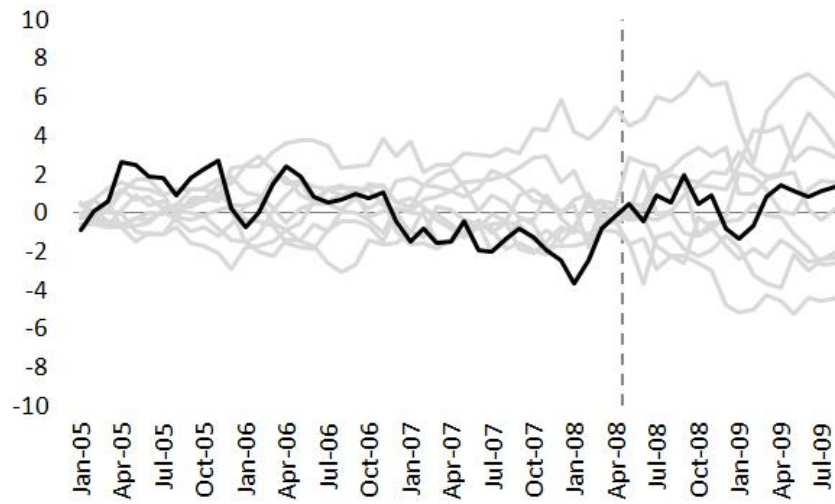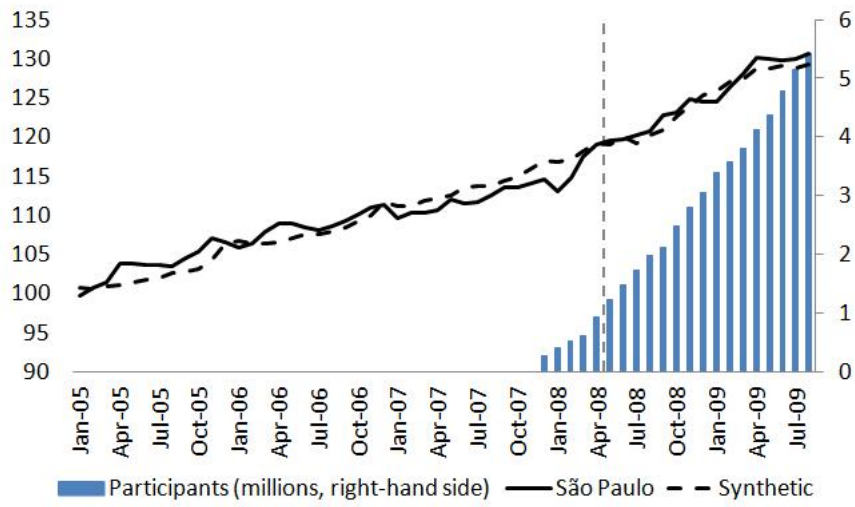
FIGURE A.14: Personal Hygiene Inflation
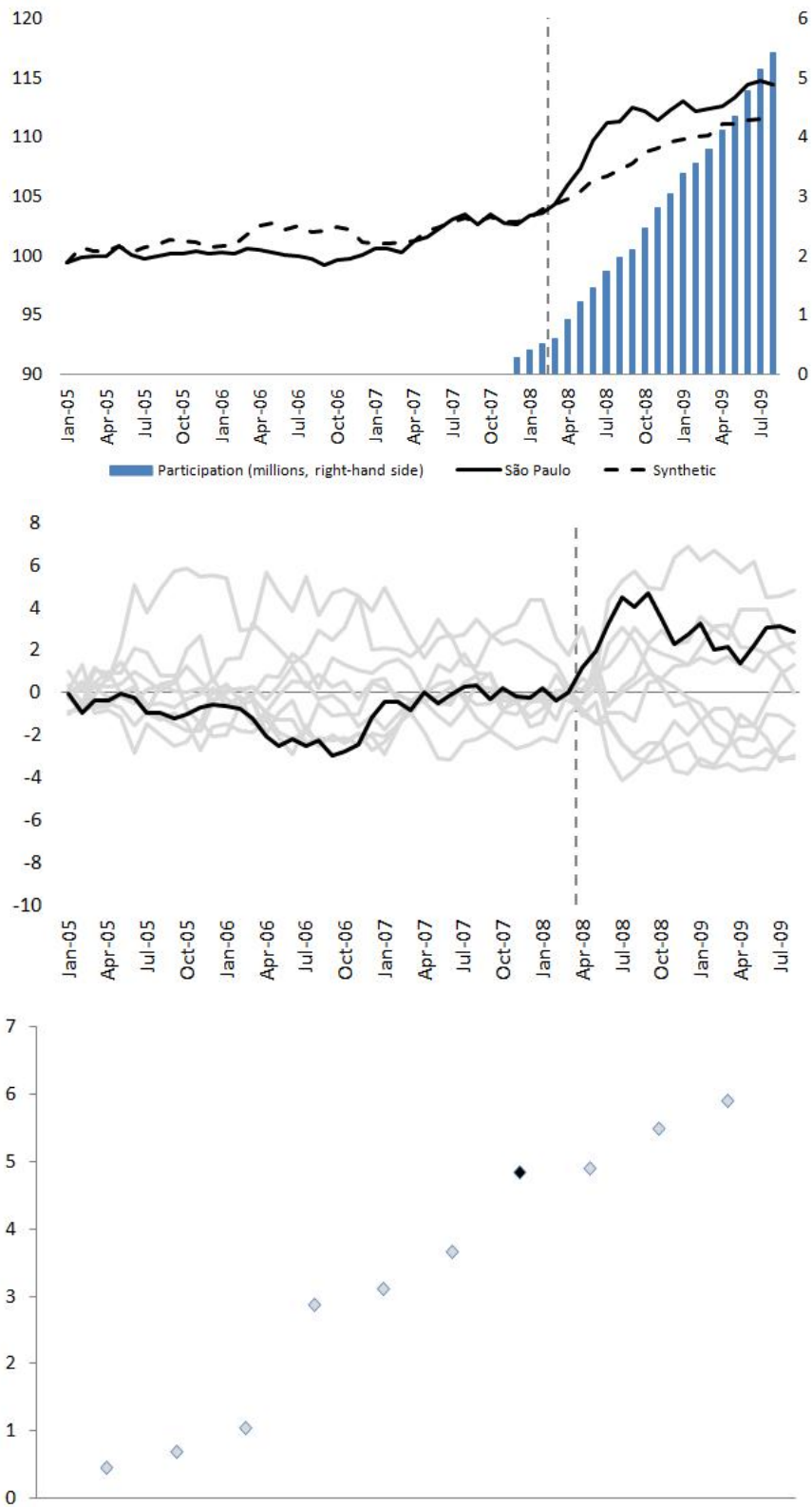
B
Tables

TABLE B.1: NFP - Entry Schedule by Sector

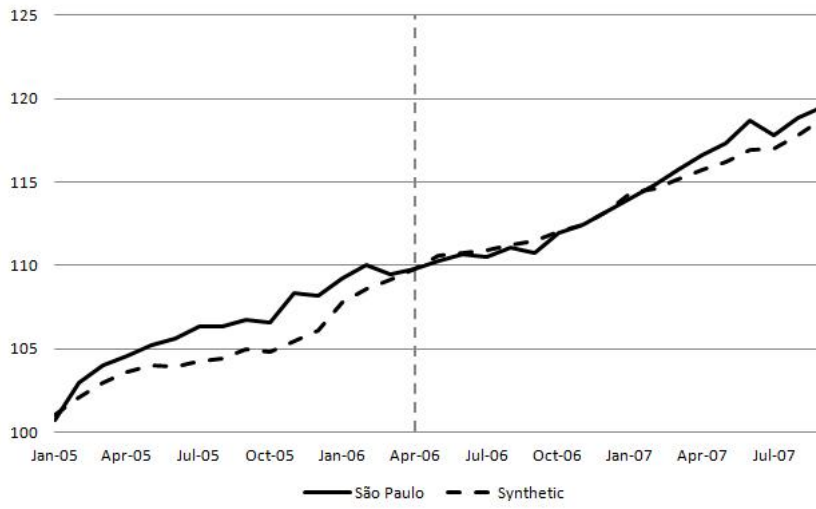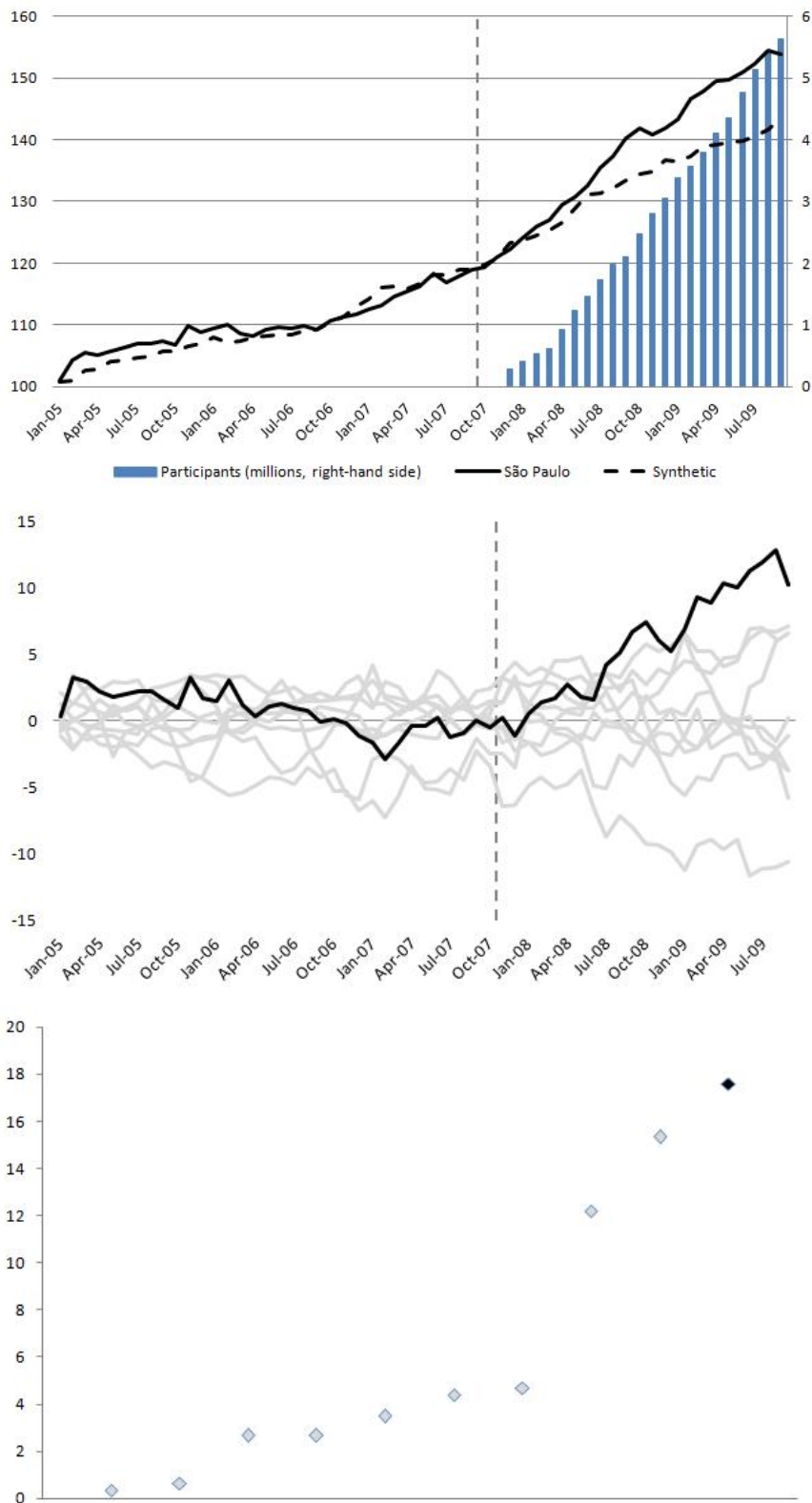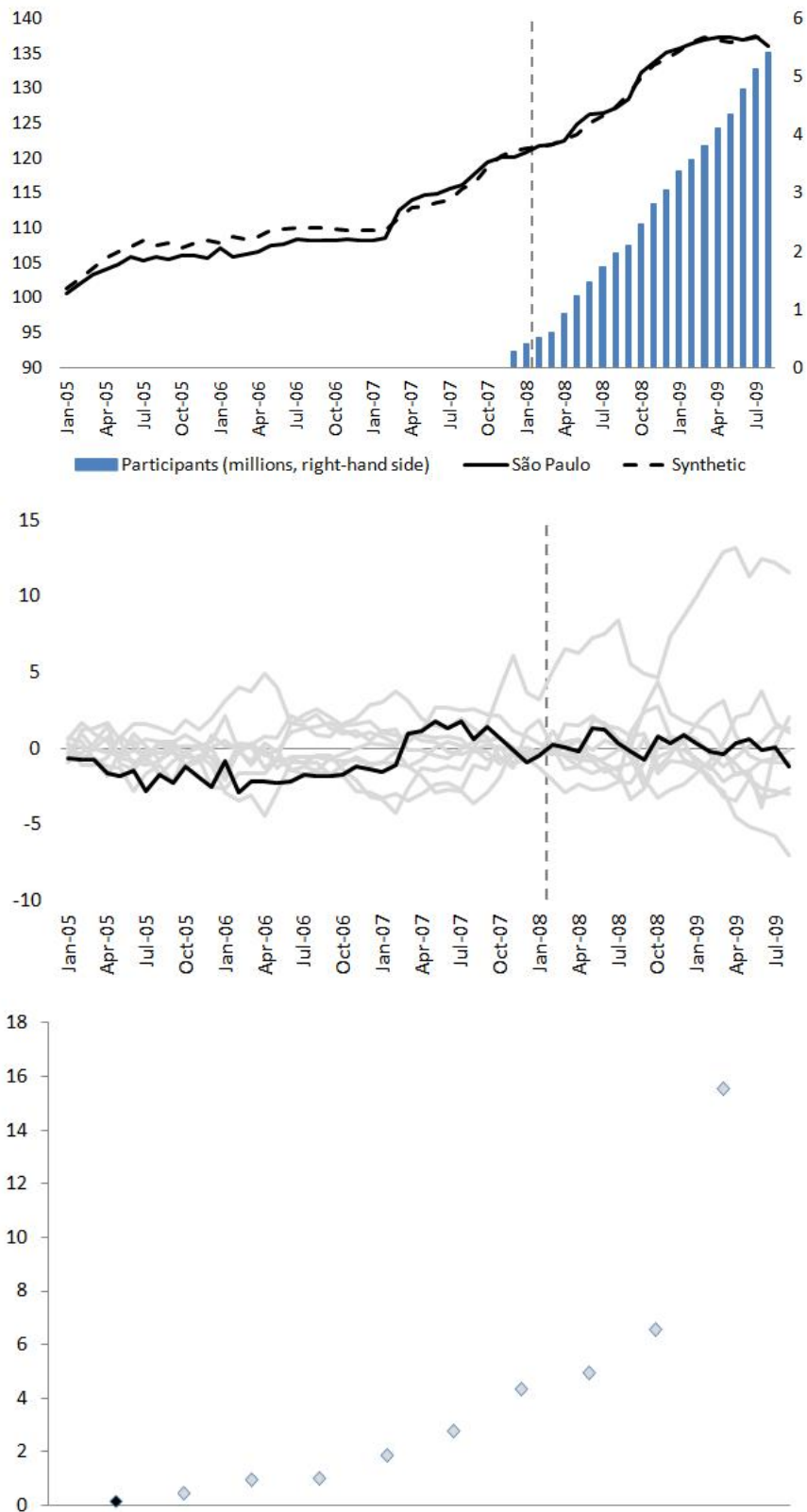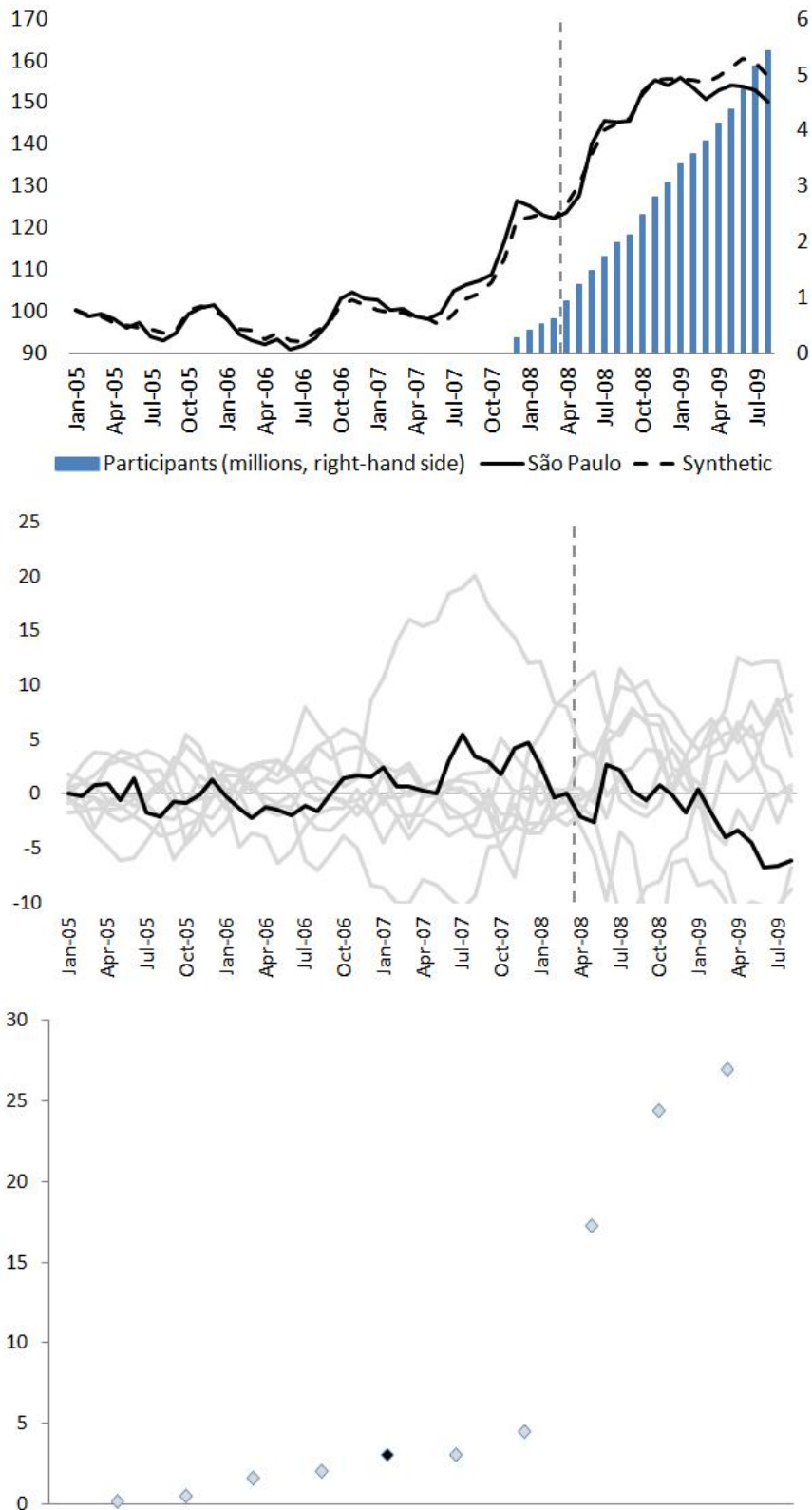| Program entry	Sector
October 2007	Restaurants
November 2007	Bakeries
	Bars and snack bars
	Other food services retailers
December 2007	Musical instruments
	Books, newspapers, magazines
	Toys
	CDs and DVDs
	Sports and travel articles
	Eyewear
	Pets
	Photography
	Guns, ammunition and fireworks
January 2008	Vehicles and accessories
	Fuels and lubricants
February 2008	Construction materials
March 2008	Computers and communication
	Appliances and furnishings
	Other household goods
	Stationery
	Antiques & Art objects
	Plants
	Office equipment
April 2008	Supermarkets
	Dairies and cold cuts
	Candies
	Meat
	Fish
	Beverages
	Vegetables and fruits
	Other food products
	Remedies
	Cosmetics, toiletries and perfumes
	Medical and orthopaedic goods
May 2008	Department stores
	Other stores and duty frees
	Tobacco shop
	Fabrics
	Clothing
	Footwear
	Jewellery and horology
	Used items
	Handicraft
	Housecleaning products
	Other products

Source: SEFAZ/SP

Table B.2: ICMS Revenues in São Paulo

	% 2007	Growth 2007-2012
ICMS	100%	73%
Energy & Oil	24%	26%
Primary Sector	0.2%	-40%
Secondary Sector	31%	104%
Tertiary Sector	39%	71%
Nota Fiscal Paulista	6.8%	56%
Antiques & Art objects	Not available	Not available
Appliances and furnishings	0.28%	141%
Bakeries	0.01%	202%
Bars and snack bars	0.10%	101%
Beverages	0.01%	230%
Books, newspapers, magazines	0.02%	99%
Candies	0.01%	68%
CDs and DVDs	0.01%	-71%
Clothing	1.02%	152%
Computers and communication	0.04%	57%
Construction materials	0.48%	32%
Cosmetics, toiletries and perfumes	0.24%	-58%
Dairies and cold cuts	0.00%	83%
Department stores	0.86%	35%
Eyewear	0.02%	181%
Fabrics	0.04%	76%
Footwear	0.18%	287%
Fuels and lubricants	0.04%	-16%
Fish	0.00%	1,243%
Guns, ammunition and fireworks	0.00%	14,071%
Handicraft	0.01%	30%
Housecleaning products	0.01%	-5%
Jewellery and horology	0.03%	270%
Meat	0.01%	-21%
Medical and orthopaedic goods	0.01%	150%
Musical instruments	0.01%	30%
Office equipment	0.00%	33%
Pets	0.02%	144%
Photography	0.00%	25%
Plants	0.00%	278%
Pharmaceuticals	0.32%	-6%
Restaurants	0.09%	139%
Sports and travel articles	0.08%	222%
Stationery	0.03%	1%
Supermarkets	1.51%	15%
Tobacco shop	0.00%	212%
Toys	0.03%	30%
Used items	0.00%	95%
Vegetables and fruits	0.00%	254%
Vehicles and accessories	0.36%	17%
Other	0.99%	7%

Source: BCB and SEFAZ/SP

TABLE B.3: ICMS revenues growth before and after the NFP

	Growth 2003-2007	Growth 2008-2012
ICMS	11.1%	11.5%
Energy & Oil	12.2%	4.8%
Primary Sector	2.9%	-9.6%
Secondary Sector	5.2%	15.4%
Tertiary Sector	16.5%	11.3%
Nota Fiscal Paulista	15.5%	9.3%
Antiques & Art objects	Not available	Not available
Appliances and furnishings	1.9%	19.3%
Bakeries	-11.3%	24.8%
Bars and snack bars	10.3%	15.0%
Beverages	3.0%	27.0%
Books, newspapers, magazines	12.1%	14.8%
Candies	9.2%	11.0%
CDs and DVDs	-4.1%	-22.0%
Clothing	25.3%	20.3%
Computers and communication	19.8%	9.4%
Construction materials	5.0%	5.7%
Cosmetics, toiletries and perfumes	15.7%	-15.8%
Dairies and cold cuts	-11.3%	12.8%
Department stores	22.9%	6.1%
Eyewear	7.7%	22.9%
Fabrics	11.1%	12.0%
Footwear	16.2%	31.1%
Fuels and lubricants	-24.5%	-3.5%
Fish	-20.2%	68.1%
Guns, ammunition and fireworks	-2.4%	169.3%
Handicraft	-3.4%	5.4%
Housecleaning products	12.0%	-0.9%
Jewellery and horology	4.1%	29.9%
Meat	2.1%	-4.7%
Medical and orthopaedic goods	-5.2%	20.1%
Musical instruments	1.1%	5.4%
Office equipment	-3.3%	5.8%
Pets	39.5%	19.5%
Photography	-14.2%	4.6%
Plants	2.4%	30.5%
Pharmaceuticals	8.4%	-1.2%
Restaurants	13.2%	19.0%
Sports and travel articles	16.3%	26.4%
Stationery	10.1%	0.3%
Supermarkets	20.7%	2.9%
Tobacco shop	3.0%	25.6%
Toys	30.5%	5.4%
Used items	22.1%	14.3%
Vegetables and fruits	22.8%	28.8%
Vehicles and accessories	17.0%	3.2%
Other	20.0%	1.3%

Source: BCB and SEFAZ/SP

TABLE B.4: Average monthly inflation over the 2-year period before the implementation of the NFP

Region	IPCA	FOH	Footwear	Eyewear	Cigarette	Dairies	Meat	Construction	Clothing	Cosmetics
Brazil	0.32%	0.49%	0.41%	0.58%	0.65%	1.13%	0.51%	0.38%	0.41%	0.10%
Belém	0.37%	0.68%	0.38%	0.59%	1.15%	1.05%	0.64%	0.37%	0.57%	0.12%
Belo Horizonte	0.42%	0.60%	0.51%	0.57%	0.63%	1.51%	0.31%	0.43%	0.58%	0.19%
Brasília	0.39%	0.48%	0.67%	0.52%	0.67%	1.18%	0.36%	0.35%	0.35%	0.24%
Curitiba	0.28%	0.41%	0.54%	0.51%	0.60%	1.07%	0.39%	0.24%	0.29%	0.05%
Goiânia	0.30%	0.55%	0.87%	0.69%	0.69%	1.32%	0.55%	0.21%	0.52%	0.16%
Fortaleza	0.31%	0.57%	0.45%	0.51%	0.54%	1.20%	0.39%	0.33%	0.34%	0.16%
Recife	0.37%	0.45%	0.36%	0.85%	0.54%	0.94%	0.35%	0.32%	0.61%	0.19%
Rio de Janeiro	0.33%	0.51%	0.77%	0.39%	0.62%	1.03%	0.24%	0.30%	0.44%	0.08%
Porto Alegre	0.26%	0.34%	0.68%	0.47%	0.67%	1.25%	1.05%	0.36%	0.22%	0.03%
São Paulo	0.28%	0.47%	0.37%	0.62%	0.66%	1.05%	0.55%	0.47%	0.34%	0.10%
Salvador	0.40%	0.47%	0.52%	0.91%	0.63%	1.00%	0.50%	0.26%	0.34%	-0.04%

Source: IBGE (Based on the seasonally adjusted series)

TABLE B.5: Average monthly inflation over the 2-year period after the implementation of the NFP

Region	IPCA	FOH	Footwear	Eyewear	Cigarette	Dairies	Meat	Construction	Clothing	Cosmetics
Brazil	0.43%	0.81%	0.54%	0.42%	1.50%	-0.21%	1.47%	0.63%	0.54%	0.39%
Belém	0.56%	0.83%	0.64%	0.58%	1.69%	-0.15%	1.63%	0.62%	0.59%	0.34%
Belo Horizonte	0.43%	0.71%	0.84%	0.40%	1.50%	-0.42%	1.68%	0.92%	0.23%	0.46%
Brasília	0.41%	0.56%	0.54%	0.20%	1.50%	-0.10%	1.47%	0.59%	0.41%	0.25%
Curitiba	0.40%	0.74%	0.35%	0.30%	1.69%	-0.23%	1.60%	0.60%	0.37%	0.49%
Goiânia	0.44%	0.78%	0.61%	0.63%	1.50%	-0.37%	1.50%	0.45%	0.46%	0.28%
Fortaleza	0.44%	0.79%	0.29%	0.41%	1.45%	-0.27%	1.54%	0.57%	0.85%	0.25%
Recife	0.48%	0.73%	0.48%	0.72%	1.50%	-0.21%	1.70%	0.50%	0.50%	0.42%
Rio de Janeiro	0.43%	0.77%	0.61%	0.23%	1.51%	-0.13%	1.43%	0.67%	0.63%	0.31%
Porto Alegre	0.44%	0.91%	0.47%	0.26%	1.48%	-0.23%	1.11%	0.63%	0.58%	0.47%
São Paulo	0.41%	0.95%	0.69%	0.51%	1.46%	-0.04%	1.46%	0.60%	0.60%	0.45%
Salvador	0.42%	0.52%	0.31%	0.44%	1.50%	-0.35%	1.54%	0.77%	0.56%	0.28%

Source: IBGE (Based on the seasonally adjusted series)

TABLE B.6: Credit Conditions

Region	% Credit 2007	12m growth	2-year period before the NFP	2-year period after the NFP
Brazil	100%	28%	55%	59%
PA (Belém)	1.3%	24%	43%	62%
MG (Belo Horizonte)	8.5%	30%	60%	60%
DF (Brasília)	2.6%	26%	51%	57%
PR (Curitiba)	7.0%	29%	52%	52%
GO (Goiânia)	3.1%	35%	67%	51%
CE (Fortaleza)	1.5%	24%	56%	72%
PE (Recife)	2.1%	25%	65%	129%
RJ (Rio de Janeiro)	11.0%	33%	66%	94%
RS (Porto Alegre)	7.4%	25%	49%	42%
SP (São Paulo)	35.5%	28%	50%	50%
BA (Salvador)	3.5%	21%	50%	58%

Source: BCB

TABLE B.7: Retail sales and size of the tertiary sector

Region	12m growth	2-year period before the NFP	2-year period after the NFP	% Tertiary Sector
Brazil	10%	16%	20%	56%
PA (Belém)	12%	10%	10%	67%
MG (Belo Horizonte)	10%	22%	16%	54%
DF (Brasília)	10%	14%	10%	83%
PR (Curitiba)	8%	13%	16%	56%
GO (Goiânia)	6%	11%	16%	68%
CE (Fortaleza)	13%	15%	18%	61%
PE (Recife)	11%	18%	18%	61%
RJ (Rio de Janeiro)	8%	14%	17%	66%
RS (Porto Alegre)	7%	10%	8%	57%
SP (São Paulo)	11%	18%	26%	61%
BA (Salvador)	12%	21%	21%	47%

Source: IBGE

TABLE B.8: GDP growth

Region	12m growth	2-year period before the NFP	2-year period after the NFP
Brazil	7.4%	6.3%	2.0%
PA (Belém)	2.9%	6.3%	1.5%
MG (Belo Horizonte)	6.3%	5.3%	2.2%
DF (Brasília)	N.A.	N.A.	N.A.
PR (Curitiba)	8.3%	4.9%	2.6%
GO (Goiânia)	4.5%	5.5%	4.9%
CE (Fortaleza)	3.4%	6.9%	5.5%
PE (Recife)	5.0%	5.3%	4.9%
RJ (Rio de Janeiro)	2.2%	2.3%	4.2%
RS (Porto Alegre)	4.5%	5.1%	2.5%
SP (São Paulo)	8.6%	5.9%	4.0%
BA (Salvador)	4.5%	4.3%	5.1%

Source: IBGE

TABLE B.9: Comparative Statistics between São Paulo and the FOH Synthetic

	São Paulo	Synthetic	Sample Average
Inflation (PTP)	19.5%	19.6%	19.0%
Inflation (12m)	6.8%	6.4%	6.1%
Credit Growth	26.3%	26.1%	25.4%
Tertiary Sector	61%	59%	60%
GDP Growth	0.7%	0.5%	0.5%
Nominal Revenues	11%	9%	10%