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A Royalty Rule

Oil producers in Brazil must pay 10 percent of the production value as royalties to different government bodies. The rule to distribute oil royalties is determined by two main pieces of legislation and depends on whether the oil is produced onshore or offshore.

5 percent parcel

Law 7.990/89 and Decree 01/91 determine the distribution of the first 5 percent of royalty payments. For onshore production, royalty distribution is straightforward: municipalities where the well is located receive 20% of royalty payments.

The distribution of royalties from offshore production follows a more complex rule. Municipalities affected by oil output receive 30 percent of total royalty payments from offshore wells. The production of the whole state is added up and divided among municipalities which are classified into three categories: (A) main production zone, (B) secondary production zone and (C) neighboring municipalities.

The main production zone comprehends municipalities which are in front of oil wells or which have in their territory three or more oil plants. The criteria to determine which municipality is 'facing' each oil well are based on parallel and orthogonal lines extracted from nautical letters. Main producing zone municipalities receive together 60% of royalty payments due to municipalities. The distribution of royalty payments within this group follows a population size rule. The National Bureau of Statistics (IBGE) is responsible to disclose municipality population every year, which is used to define the participation coefficient for each population range. This participation coefficient aims to attribute greater shares for larger municipalities but do not follow a linear rule. The law also guarantees that municipalities which concentrate production facilities should receive at least one third of the share distributed to municipalities in the main production zone. Hence, the share that each municipality in the main zone receive depends on its location, population and oil producing plants and the ones from its neighbors.

The secondary production zone receives 20% of royalty payments due to municipalities and is composed by municipalities which are crossed by pipe-

lines. The neighboring municipalities receives the remaining 10% of municipal share. A municipality is classified in this group if it borders the main producing zone or if it is from the same mesoregion of main production zone municipalities. The mesoregion is a geographic classification established by IBGE and is not related to royalty payments or oil output. The distribution within these zones also takes into account the population size rule.

Therefore, the share of royalties that municipality i receives from offshore production is :

$$royalties_i = \quad\quad\quad\quad\quad\quad\quad\quad (\text{A-1})$$

$$municshare_{Ais}*0.6*0.3*0.05*OutputState\ if\ i \in A = MainProductionZone$$

$$municshare_{Bis}*0.2*0.3*0.05*OutputState\ if\ i \in B = SecondProductionZone$$

$$municshare_{Cis}*0.1*0.3*0.05*OutputState\ if\ i \in C = NeighbMunicipalities$$

where $municshare_{jis}$, $j \in \{A, B, C\}$ is the municipal share of municipality i from state s. This share depends on municipality population and the number and population of other municipalities in the same group at the same state such that $\sum_i municshare_{jis} = 1$ for each state.

The royalty rule also guarantees 10% of royalty payments to municipalities which have facilities to support transportation to and from oil sites. This share is equally distributed among all the municipalities in Brazil who have this kind of facility, but it considers in different groups municipalities with facilities which support onshore fields and the ones that support offshore fields.

Second 5 percent parcel

The Oil Law (9.478/97) enacted in 1997 and regulated by Decree 2.705/98 increased royalty payments from 5% to up to 10% but determined different criteria to distribute the second parcel of royalty payments.[1]

In relation to onshore royalties, few changes were introduced. Municipalities where the oil field is located receives 15% of its royalty payments (0.15 x 0.05 x OutputField).[2]

In turn, the rule to distribute royalties from offshore fields was dramatically simplified. 22 percent of the second parcel of royalty payments from offshore production is paid to municipalities located in front of the field. The criteria to determine which municipality is 'facing' each field are also based on the same parallel and orthogonal lines to the Brazilian coast. A combination of both lines creates the 'facing quotas', which are the percentage of each oil field located in front a each municipality. Hence, the amount that each coastal

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[1]The size of the second parcel varies with exploration risk involved in the oil field under contract and range from 1 to 5 percent.

[2]The change of nomenclature from well to field is not accidentally. Law 9.478/97 use the field as a reference rather than the well

municipality receives from offshore production is equal to (FacingQuota x 0.22 x 0.05 x OutputField).

Finally, the second parcel of royalty rule also distributes 7.5% of royalty payments to municipalities which have facilities to support transportation to and from oil sites. But in this case, the distribution within this group considers the amount of oil transported by each facility.

B Oil Data

B.1 Oil output

The Brazilian Oil National Agency (ANP) is the main source of information on oil sector in Brazil. Since August 1998, it discloses monthly data on oil and gas production and prices by oil field. This information allows us to calculate oil output from 8/1998 to 12/2009 for each oil field by using the formula Output = OilPrice x OilProduction + GasPrice x GasProduction.

Data from the 1991 to 1997 were gathered at the December editions of Oil and Gas Journal. From 1991 to 1997, the magazine reported the average number of barrels of oil produced daily by each oil field. We measure the annual production by multiplying the average daily production by 365. However, this Journal does not provide information on prices, which are necessary to calculate production value. We rely on ANP (2001a) to calculate implicit prices by using the information on total royalty payments and total production. The price per barrel was obtained by using the formula: price=royalties /(0.05 x OutputBarrels). We did not compute prices from 1991 to 1993 since this was a high inflation period, what dramatically challenge the calculation of monetary values. We are confident about using this average price per year for the whole country because oil price was controlled by the state and did not fluctuate with exchange rate and international price before Oil Law was enacted in 1997. A final calculation was necessary to obtain 1998 annual production values since Oil and Gas Journal did not disclose information per oil field for that year. We rely on ANP information from August to December (the first ones available) to calculate 1998 production value as 12/5 x (OutputAugDec).

The next step was to associate oil fields with municipalities in order to obtain production values per municipality. We localized the onshore fields by using GIS information provided by ANP's Exploration and Production Database (Banco de Dados de Exploracão e Producão - BDEP). An onshore oil field is assigned to one municipality if its boundaries falls within a municipality border. In the case of oil fields whose boundaries cover more than one municipality, we distribute the production by considering the percentage of the area of the oil field located on the municipality. In the case of offshore

production, we assigned oil fields to each municipality by using the list of facing quotas disclosed by ANP.The facing quotas are monthly disclosed by ANP at `http://www.anp.gov.br/?pg=14431` under the name 'Confrontação Month Year.pdf'.

We should note that we were not able to find the location of all oil fields listed on Oil and Gas Journal on DBEP or ANP database. The fields we didn't localize are responsible for less than 1 percent of total production in a given year and could not have their production assigned to a specific municipality only to the state.[1]

In order to double check our calculation, we added municipal oil output by state and year and compared these number to the ones disclosed at ANP (2001a). The series from 1994 to 1997 constructed based on data provided by Oil and Gas Journal are almost the same to the one informed by ANP at state level (correlation 0.9997), which support the quality of the data provided by the Journal. For the period from 1998 to 2008, our series also match almost perfect to the one disclosed by ANP (2001a).

B.2 Royalty payments

Data on royalty payments made to each municipality are disclosed monthly by ANP from 1999 to 2008 at `http://www.anp.gov.br/?pg=9080`. Data from 1994 to 1998 were calculated by us by following in detail the rule described in ANP (2001b) and relying on the information on production value per municipality (calculated as described above using data from Oil and Gas Journal).

Note that from 1994 to 1997, only the first 5% parcel of royalties was paid. The second parcel of royalties began to be paid on October 1998.[2] Hence, the main task to compute royalty payments for this period is to replicate the first parcel rule. We describe that first.

The computation of onshore oil royalties is the easiest part. By using GIS database provided by BDEP, we could match municipal borders with oil field borders and attribute to each municipality 0.2 x 0.05 x ShareFieldMunicipality

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[1]The production of all non-localized fields represents 0.17 percent of total production in 1994, 0.83% in 1995, 0.67% in 1996, 0.15% in 1997. In most of the cases, they are small oil fields which should have been phased-out due to low production. The largest producing fields not identified are fields which are by the time in their early phases of production and therefore hadn't had a name but rather a code. We weren't able to match these codes with the new names.

[2]Although Oil Law was enacted in June 1997, decree 2.705/98 which detailed the rules for paying the second parcel was just enacted in August 1998. The second parcel of royalty payments was paid for the first time in October because royalties are due two months after production. This information was provided by ANP technicians.

x OutputField.[3].

For offshore oil royalties, the task is more cumbersome. In order to calculate royalties from 1994 to 1998, we need not only the information on producing municipalities but also the list of municipalities which have three or more oil plants (classified as being part of main producing zone), the ones crossed by pipelines (secondary zone), the neighboring municipalities and the ones from the same mesoregion to a municipality in the main producing zone.

Since no list was found for the 1990s, we rely on ANP (2001b) which provide information for 2000 and assume that the same municipalities were affected by oil output in the 1990s. According to ANP (2001b), eight municipalities are classified in the primary zone in 2000 because they have three or more producing plants. They are: São Sebastião do Passé (BA), Paracuru (CE), São Mateus (ES),Macaé (RJ), Guamaré (RN), Itajaí (SC), Aracaju (SE) e Cubatão (SP). We compose the list of main producing zone municipalities by listing these municipalities and the the ones facing oil fields under production during the 1990s, which are determined in accordance to 'facing quotas' list[4] Royalty payments to each municipality within this group were calculated using equation A-1, taking into account that Macaé (RJ) and Cubatão (SP) concentrated oil facilities and deserves at least 33 percent of royalty payments to main producing zone in their respective states.

ANP (2001b) also reports that there were ten municipalities in 2000 crossed by pipelines which compose the secondary zone: Fortaleza (CE), Cachoeiras de Macacu (RJ), Duque de Caxias (RJ), Guapimirim (RJ), Mage (RJ), Rio de Janeiro (RJ), Silva Jardim (RJ), Praia Grande (SP), São Paulo (SP), São Vicente (SP). The distribution of royalties to these municipalities also follows the population size rule[5] and equation (A-1).

The list of neighboring municipalities is determined by using mesoregion codes provided by IBGE. Based on this list, we distribute royalty payments within this group taking into account the population size rule and equation (A-1). Note that municipalities can receive royalties for more than one reason. For instance, a municipality can receive royalties because it has transportation

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[3]This calculation requires a simplification because the law determines the payment according to oil well rather than the field. For fields entirely within one municipality border, that is not a problem. For fields which extend from more than one municipality, one may think the use of ShareFieldMunicipality as assessing the probability that the well is located within the municipal border.

[4]Note again that the law states that distribution should follow well location rather than the field, which is the unit of analysis in our dataset. We don't believe, however, that this is a major limitation since we can think about the use of these 'facing quotas' as assessing the probability that the well is located in front a specific municipality, which is equal to the share of that field in front of the municipality.

[5]The population size rule can be found at ANP (2001b).

facilities and because it is a neighboring municipality. Hence, we calculate all these quotas independently for each municipality and each year and then add them up.

Finally, we need to determine the list of municipalities with facilities which support transportation from and to oil sites. This again was extracted from ANP (2001b). In 2002, 57 municipalities had facilities which support onshore production and each of them receive (1/57)*0.1*0.05.ProductionValueOnshoreBrazil. In turn, 15 municipalities have transportation facilities to and from offshore site and each receive (1/15)*0.1*0.05.ProductionValueOffshoreBrazil (see ANP (2001b) for the list of municipalities).

After concluding the computation of the first parcel of royalties, we still need to input the second parcel of royalty payments for 1998. Onshore producing municipalities received additional 0.15 x 0.05 x ShareFieldMunicipality x 3/12 x ProductionValueField1998, while offshore producing municipalities received 0.22 x 0.05 x ShareFieldMunicipality x 3/12 x ProductionValueField1998, where 3/12 stands for three months in that year. We were not able to compute royalties relative to the second parcel for municipalities with transportation facilities. We didn't find information on the volume handled by each facility, which would be necessary to distribute royalties. We don't believe this is a major problem because we are losing just three months of payments.

B.3 Other data

Other variables used in this paper were gathered from different sources as following described.

Electoral information. We use Tribunal Superior Eleitoral (TSE) microdata for 1996, 2000, 2004 and 2008 local elections that is provided by TSE under request. TSE also sent us a list of candidates and parties elected in 1992, which allows us to construct 1996 party reelection variable.

Municipal finance. Data on public finance, including revenues and expenses, are available from Brazil's National Treasury through 'Finanças do Brasil' (FINBRA) database from 1997 to 2008 at `http://www.tesouro.fazenda.gov.br`. Some municipalities do not declare FINBRA every year and sometimes do not provide all the information requested. We use only data from municipalities which report most of revenues and expenses but we do not perform any correction for the years that municipalities did not declare. Hence, our analysis of municipal finance is based on an unbalanced panel.

Public employees. Data on the number of municipal public employees, their composition and wages were gathered from Registro Anual de Informações Sociais (RAIS), a database that comprises all formal workers in

Brazil. The Brazilian Ministry of Labor (MTE) collects that information and disclose it in Cd-Roms, which are available upon request.

Economic activity. RAIS provides information on private employees, total payroll and number of firms per sector. Municipal GDP is available from IBGE for 1999-2007 period at `http://www.ibge.gov.br/home/estatistica/economia/pibmunicipios/2006/default.shtm`.

Educational data. Educational outcomes are provided by Instituto Nacional de Estudos e Pesquisas Educacionais Anísio Teixeira (INEP) at `http://www.inep.gov.br` from 1996 to 2006.

Health supply. The number of municipal health clinics and hospitals are available at DATASUS's site (See `http://www.datasus.gov.br`). Cadastros Extintos do SUS discloses information for 1998-2002 period, while Cadastro Nacional de Estabelecimentos de Saude (CNES) publish data for 2006-2008. We named health clinics the sum of 'unidades basicas de saude' and 'postos de saude'. Hospital units include 'Ambulatório de Unidade Hospitalar Geral' and 'Ambulatório de Unidade Hospitalar Especializada' in CNES database and 'Hospital Dia', 'Hospital Geral' and 'Hospital Especializado' in Cadastros Extintos do SUS database. We considered only health units managed by the local government.

Geographic characteristics. We gathered data on municipalities' geographic characteristics such as latitude, longitude, altitude and distance to the state capital at IPEADATA site (`http://www.ipeadata.gov.br`). IPEA also provides 1991 and 2000 population census variables such as population density, percentage of urban households and average years of schooling.

Population estimates. Inter-census population estimates are available at `http://www2.datasus.gov.br/DATASUS/index.php?area=0206`.

C Model Appendix

C.1 Posterior variance

$$Var(\tilde{a}) = \tilde{\sigma} = Var(\frac{g + r^e}{T}) = \frac{Var(g)}{T^2} = \frac{Var(a(T+\theta))}{T^2}$$

$$= \frac{Var(a)E(T+\theta)^2 + E(a)^2 Var(T+\theta) + Var(a)Var(T+\theta)}{T^2} = \sigma + \frac{\mu^2 v + \sigma v}{T^2}$$

C.2 Partial effects on rents:

Let
$$\frac{\partial p_I}{\partial r} = -\frac{\epsilon\sigma}{(\tilde{\sigma}+\sigma)T} = -\frac{\epsilon\sigma T}{\sigma(2T^2 + v) + \mu^2 v} = -F$$

$$Signal\{\frac{\partial r}{\partial \rho}\} = -Signal\{\frac{\partial F}{\partial \rho}\} \ where \ \rho = \{\epsilon, v, \sigma, T\}$$

$$\frac{\partial F}{\partial \sigma} = \frac{\epsilon T \left[\sigma v + \mu^2 v\right]}{\left[\sigma v + \mu^2 v + 2\sigma T^2\right]^2} > 0$$

$$\frac{\partial F}{\partial T} = \frac{\epsilon\sigma \left[\sigma v + \mu^2 v - 2\sigma T^2\right]}{\left[\sigma v + \mu^2 v + 2\sigma T^2\right]^2} = \frac{-\epsilon\sigma \left[3\sigma - \tilde{\sigma}\right]}{\tilde{\sigma}+\sigma} < 0 \ \Leftrightarrow \ \tilde{\sigma} < 3\sigma$$

C.3 Partial effects on reelection probability

$$p_I^* = \frac{1}{2} + \frac{\epsilon\sigma}{\tilde{\sigma}+\sigma} \left[\frac{(a+\theta)T}{T} - \mu\right] = \frac{1}{2} + \frac{\epsilon\sigma T \left[(a-\mu)T + a\theta\right]}{\sigma(2T^2 + v) + \mu^2 v}$$

$$\frac{\partial p_I^*}{\partial \sigma} = \frac{\epsilon T \left[(a-\mu)T + a\theta\right] \left[\sigma v + \mu^2 v\right]}{\left[\sigma(2T^2 + v) + \mu^2 v\right]^2}$$

$$\frac{\partial p_I^*}{\partial \sigma} > 0 \Leftrightarrow \ a > \frac{\mu T}{T+\theta}$$

$$\frac{\partial p_I^*}{\partial T} = \frac{-\epsilon\sigma \frac{\partial \tilde{\sigma}}{\partial T}}{(\tilde{\sigma}+\sigma)^2} \left[\frac{a(T+\theta)}{T} - \mu\right] + \frac{\epsilon\sigma}{\tilde{\sigma}+\sigma} \left[\frac{aT - a(T+\theta)}{T^2}\right]$$

$$= \frac{-\epsilon\sigma}{\left[(\tilde{\sigma}+\sigma)^2 T^2\right]^2} \left[2T(\mu^2 v + \sigma v)(a-\mu) + a\theta(\tilde{\sigma} - 3\sigma)\right]$$

$$= \frac{-\epsilon\sigma}{[(\tilde{\sigma}+\sigma)^2 T^2]^2} \left[2T(\mu^2 v + \sigma v)(a-\mu) + a\theta(\mu^2 v + \sigma v - 2\sigma T^2)\right] > 0 \;\Leftrightarrow$$

$$2T(\mu^2 v + \sigma v)(a-\mu) + a\theta(\mu^2 v + \sigma v - 2\sigma T^2) > 0$$

$$\Leftrightarrow\; \sigma < \frac{2T\mu^2 v\,[(a-\mu) + a\theta]}{a\theta(2T^2 - v) - 2Tv(a-\mu)}$$

D Coding Disque-Denuncia Reports

This appendix explains how we used Disque-Denúncia reports to construct violence indicators. We gathered from Disque-Denúncia (DD) all reports classified as 'gun fight between drug-gangs' (tiroteio entre facções) registered between 2004 and 2009 in the city of Rio de Janeiro. The content of each report varies a lot but in all cases it contains the date of the call, a location reference and a description of the event. Most of the reports are simple as the one below:

Inform that drug dealers from the referred slum are currently in a battle with rival drug dealers. The gunfight is intense and people are worried. Demand police intervention. Address provided: Morro da Mangueira.[1]

Other reports are incredibly rich, provide important information for the police (eg.the location of a drug dealer) and show how violent these events are:

Report that today (10/26/2005), at 7:00AM, there was a gunfight in front of the school Vicente Mariano between drug leaders from Timbau slum and Vila do Pinheiro slum. A man was killed and five children were shot. ... The traffic leader had intentionally shot in the school direction. This guy, whose nickname is Night, is currently located at rua Capivari, 55. Address provided: Maré slum.[2]

The two examples above also show that although DD always asks for the full address (street name, number and zip code), people do not always

[1]Original report: 'Relata que traficantes do morro citado se encontram nesse momento trocando tiros com traficantes rivais. Informa que a troca de tiros é intensa e os moradores estão preocupados. Sem mais, pede policiamento para o local."

[2]Original report: 'Informa que hoje (26/10/2005), as 07h, ocorreu um tiroteio na favela da Maré, em frente ao Brizolão Colégio Vicente Mariano, confronte entre o tráfico do morro do Timbau e Vila dos Pinheiros onde causou a mote de um adulto e o ferimento de cinco crianças (não identificados), estudantes do colégio supra citado, que encontram-se no hospital geral de Bonsucesso em estado grae. Relata que o chefe do tráfico do morro do Timbau, identificado como Night, foi o responsável pelos disparos, pois direcionou sua arma para o colégio atirando impiedosamente, provocando este acidente. Declara que Night pode ser encontrado neste exato momento, em uma casa, no alto do morro, na rua capivari, próximo ao numero 55, no local onde existe uma placa informando tratar-se do beco da escolinha. Sem mais, pede providências."

provide it in detail. In both cases, just the name of the slum was provided. The exact location of the second event was even harder to identify since the person mentioned Maré, which is the name of a slum complex. In order to deal with these issues, we relied on a combination of addresses provided, the name of the slum (when it was mentioned) and the content of each report to identify where the described event took place. Based on that information, we associated each report to a city slum by using the slum shape file provided by Instituto Pereira Passos (IPP). In some cases, this association was not straightforward due to three reasons. First, many times the name of a slum was not mentioned in any part of the report. In this case, we opened the slum shape file on Google Earth and added the address or other information provided in the report (for instance, in the second example, we added the address of school Vicente Mariano). In case the address was within a slum or close to its border, the report was associated with the respective slum. The addresses far away from a slum were classified as 'paved area' (asfalto) and were excluded from our sample. Another challenge is the fact that people use different names to refer to the same slum and the slum name used by IPP does not always match the one most used by the population. For instance, the slum popularly called Parada de Lucas or just Lucas is registered in IPP as 'Parque Jardim Beira Mar'. Fortunately, IPP also provides a list with alternative names for the same slum, which allows us to match the names used by population with the ones in IPP's shape file.[3] Finally, some reports mentioned that a gunfight occurred in places that are not officially slums but rather housing projects or irregular settlements, which are not marked in IPP's slum shape file. For instance, several reports mentioned a conflict in Conjunto Guaporé, Cidade Alta or Conjunto Fumacê, which are housing projects. To keep from losing that information, we used Google Earth and the addresses provided in the reports to draw borders for these areas and incorporated them in the slum shape file.[4]

In addition to standardizing the address, we read the content of each report to guarantee that each one indeed describes a gunfight that took place on the date and at the address registered. Hence, we marked the reports that mention the threat of a gunfight or the location of bodies and drug dealers but

[3]In the cases that the IPP list didn't have the slum name provided in the DD report, we used the address provided and Google Earth to make the match.

[4]We added 14 borders in IPP's slum shapefile which represents the following housing projects or irregular settlements (neighborhood indicated in parenthesis): Vila do Pinheiro (Maré), Vila do João (Maré), Conjunto Guaporé (Brás de Pina), Conjunto Alvorada (Santa Cruz), Conjunto Cezarão (Santa Cruz), Favela do Rola (Santa Cruz), Guandu II (Santa Cruz), Morro das Pedrinhas (Santa Cruz), Cidade Alta (Cordovil), Vila Alice (Laranjeiras), Cruzada São Sebastião (Leblon), Conjunto Mangariba (Paciência), Conjunto Cavalo de Aço (Senador Camará) e Conjunto Fumacê (Realengo)".

did not mention that a gunfight occurred at that place and date. We exclude these reports from our sample. In addition, some reports provide an address, but the content refers to a conflict that happened in another place. In this case, we corrected the address to guarantee that it informs where the event happened. For instance, the report below was registered as Baixa do Sapateiro, but the content led us to change it to 'Avenida Canal', which is the official name of Vila do Pinnheiro slum, and where the conflict took place according to the report.

Inform that drug dealers from the slum mentioned, which are part of Terceiro Comando gang, invaded Pinheiro slum, which is dominated by ADA. Both slums are located in Maré... Address: Baixa do Sapateiro.[5]

A similar adjustment was necessary for the dates. Sometimes people call and report that a gunfight occurred three days before and DD registers the call date. We corrected the dates to guarantee that they refer to when the event took place.

This procedure generated a slum list containing the dates on which a gunfight took place. We then aggregated the data per slum and year by counting the number of days that at least one report of armed conflict was registered in Disque-Denúncia. Table 3.2 provides the descriptive statistics of Disque-Denúncia reports.

Bellow, we give more examples of original reports and how we classified them in order to clarify our methodology.

Informs that this avenue is one of the access points to Morro do Cajueiro, which will be invaded today at night by people from Morro da Serrinha. These people want to revenge the death of three colleagues that were killed by the rival gang. The attempt to invade the slum has been planned since these guys began to steal cars in the neighborhood. Address: Avenida Ministro Edgard Romero. Date: 10/22/2004.

[5]Original report: 'Informa que traficantes (não identificados) da favela em questão, que pertencem a facção criminosa Terceiro Comando, invadiram a favela do Pinheiro, que pertence a facção ADA, ambas situadas no complexo da Maré, Afirma que a invasão ocorreu sábado a tarde, por volta as 18hs, com intuito dos traficantes assumirem os pontos de boca de fumo da favela rival. Menciona que a invasão aconteceu devido a retirada das viaturas que ficavam frequentemente na entrada da favela do Pinheiro, que tem acesso pela linha amarela. Segundo informações, traficantes da favela em questão, teriam pago aos policiais (no identificados) lotados no 22 BPM, para se retirarem do local para assim eles poderem invadir a favela rival com mais facilidade. Disse que ontem (09/11) todos os estabelecimentos da favela acima estavam com as portas fechadas com a ordem passada pelo tráfico, pois provalmente algum indivíduo teria sido morto pela guerra das facções. Pode que o policiamento retorne ao local."

Morro do Cajueiro is an alternative name for Morro do Sossego, which is the name in IPP's shape file. This report was not included in our sample because it mentions only the threat of a conflict.

Reports that in the mentioned road, close to the school Chiquinha Gonzaga, several drug dealers were seen yesterday around 10 pm with the possession of heavy guns and motorbikes. There was an intense gun fight and a car was severely shot. The gun fight took one hour and the group escaped to Vila Aliança, close to Beira Rio store (......) Demands police intervention in the region. Address: Estrada do Engenho, Bangu. Date: 10/31/2006.
We changed the date of this report to the day before (10/30/2006), when the conflict actually happened, but we ended up not using this report because it was not close to a slum.

Reports that in this street, which is the entrance to Favela Boogie Woogie, is the location of school Olga Benário, where it is possible to find several drug dealers from Terceiro Comando. One of them is known as 'Grilo' and he is the son of a school employee. Drugs are sold inside the schools during class breaks. Yesterday, at 4:30 pm, drug dealers from Comando Vermelho tried to invade the school. There was an intense gun fight. Address: Rua Dante Santoro, Cacuia, Ilha do Governador. Date: 8/22/2003. This report mentions the proximity to favela Boogie Woogie, whose official name is Bairro Nossa Senhora das Graças. Therefore, we associated this report to this last slum name. In addition, we changed the day of the report to the previous day (8/21/2003), when the event took place.

Report that in the mentioned street is the location of Guaporé housing project. A gun fight is taking place right now between drug dealers from rival gangs. A senior lady and a young boy were wounded. Address: Rua Carbonita, Brás de Pina. Date: 8/14/2004.
We drew the border of Guaporé housing project using Google Earth and added it to IPP's shape file in order to incorporate this and other reports in our analysis.

E Triggers of Drug Battles

This appendix provides more transcripts gathered from Plantão de Polícia and Casos de Polícia blogs. Our aim is to provide evidence that drug battles follow a unique dynamic that depends on betrayals, revanchism, the imprisonment or release of a gang leader and others.

Six bodies were found in Morro do Juramento. These people were killed in an 11 hour conflict that took place last Tuesday. CV drug dealers tried to reconquer the area, which is dominated by Terceiro Comando Puro (TCP). Last month TCP overthrew the area from ADA. (Source: Meia Hora, 9/20/2009)

...in July, Marcus Viniï¿½½cius Martins Vidinhas Júnior, known as Palhaço, betrayed his father-in-law, Celsinho da Vila Vintém, who is in jail but is still the slum drug baron. Palhaço killed 13 drug gang members in order to control drug trade slots. Two days later, Celsinho allies deposed Palhaço, who ran away with guns and R\$ 1 million. (Source: Meia Hora, 9/22/2009)

An intense gunfight took place yesterday night at Morro do Dendê. Chorrão (ADA) and Pixote attempted to conquer the slum, which is dominated by Fernandinho Guarabu (TCP). Pixote is a former member of Guarabu gang. (Source: Meia Hora, 10/11/2009)

In addition, several reports to Disque-Denúncia also provide examples on what trigger conflicts:

Informs that at the given address it is possible to find fugitives and drug dealers, who yesterday were involved in a gun conflict. Today, the mother of one of the boys was shot to death in the Estrada Porto Nacional. This group is part of Pipa's gang, who was recently murdered in jail. Pipa's death explains the attempt against his supporters. It concludes by mentioning that the school Piquet Carneiro received an order to close. Date: 3/26/2004 2:19 PM

Reports that the slum mentioned and Morro do Timbau, which are

controlled by Facão, were invaded today by more than 80 drug dealers. Some of them are known as 'Noquinha', 'Sassá', 'Alex Churrasquinho', 'Nelsinho', 'Daniel do Lava Jato', 'Ilton', (…). There are others from Morro do São Carlos. They are from ADA gang, are heavily armed, are led by Gan Gan and aim to kill Desviado, the leader of Baixa do Sapateiro, and the drug trade manager Tico. The gun fight began at noon and these drug dealers are still around the slum, shooting without a specific target and leaving slum inhabitants in panic. Date: 1/11/2004 5:20 PM

Inform that in Parque Alegria slum a gun fight is taking place right now among drug dealers. Yesterday, during the day, the drug dealers Nêgo Dengo and Araketu killed a person and this is the reason for the current gun conflict. Drug dealers connected with the person who died invaded the slum to take revenge. Demands intervention because several people are being shot by stray bullets. Date: 12/12/2006 3:37 PM.