Differences in the Public Sector: Essays on Secession Threats and Wage Differentials

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Preface

Differences that involve the public sector can have implications on the country at large. This dissertation describes selected situations associated with two forms of differences: difference in preferences and difference in incomes.

Difference in preferences is fundamental in any society with non-homogeneous individuals. This difference comes in various intensities, from subtle differences to strong differences, which can give rise to a variety of scenarios. The first two chapters of this dissertation cover situations when difference in preferences manifests in a threat of secession.

A threat of secession can be motivated by several reasons, prominent among which is difference in preferences for fiscal policy, redistribution, the size of government, or cultural development (Alesina and Spolaore 1997; Bolton and Roland 1997). The possibility of secession becomes an active threat once an organized group or political party claims independence for a specific region or faction. Episodes of secessionism are rampant throughout history. Many countries have at some point had to deal with threats of separation. Borders were either retained or redrawn as a consequence of these episodes (Radan 2007).

Claims for independence take violent forms in some countries while campaigns in other countries are carried out in a diplomatic manner. Chapter 1 depicts a non-violent scenario and explains an approach in preventing separation that does not involve armed conflict. Chapter 2, on the other hand, measures impact on national output when a threat of secession turns into civil conflict.

In Chapter 1, the threat of secession is modelled as a decision of a minority region that seeks to uphold its own preference when it comes to public policy. This region will realize gains from independence through its preferred policy. If its gain from independence is decreasing in public debt, then the national government can prevent secession by raising the debt level

up to a point where the minority region's potential gain from independence dissolves. This implies that the threat of secession creates a tendency for the national government to issue an inefficiently high level of public debt. While this choice of debt is inefficient, it is strategically effective in preempting separation and thus preserving unity at the equilibrium.

In Chapter 2, the outcome is measured when the threat of secession is taken to a whole new level. It looks at the violent conflict in the Philippines where armed groups are claiming independence for the southernmost areas. This difference is rooted in history. The conflict has intensified and remained unresolved. This chapter estimates the loss in economic output resulting from this conflict. It uses the synthetic control method (Abadie and Gardeazabal 2003; Abadie *et al.* 2010) in measuring the causal effect of a historical intervention. It finds that the Philippine GDP per capita began to diverge from its counterfactual path (levels of GDP per capita through the years if the conflict had not taken place) as soon as the secessionist conflict broke out. This foregone economic output of the whole country can be attributed to the violent threat of secession, for reasons explained in the chapter.

The last chapter is about difference in incomes. Specifically, it measures the difference in hourly wage rates paid on the Philippines' public sector employees and their counterparts in the private sector. It answers the question of whether public sector workers in this developing country are receiving lower or higher wages as employees of the government rather than of private employers.

In Chapter 3, public sector workers are found to earn higher wages compared with their private sector counterparts. They are also found to be working fewer hours and to be characterized with less specialized skills. However, they exhibit higher levels of pro-social behaviour. This public sector premium in pro-social behaviour is consistent with the public wage premium that government employees are receiving.

Each chapter in this dissertation is self-contained. It can be read independently.

Chapter 1

Public Debt and the Threat of Secession

1.1 Introduction

Some countries are dealing with a threat of secession over a long period of time. As these secessionist conflicts remain unresolved, these same countries also carry high levels of public debt (Public Sector Debt Statistics, World Bank and International Monetary Fund). What explains this persistence of unresolved secessionist conflicts alongside large national debt? Could these debt levels possibly explain why actual separation does not occur? This chapter applies a game theoretic framework to examine whether public debt plays a strategic role in preventing the breakup of nations.

The idea that public debt has the potential to prevent secession runs counter to the notion that higher debt – and thus lower economic prosperity – is associated with political instability. Truly, many of the countries subject to secessionist threats are characterized with less than stellar economic performance. There is no doubt that instability in the political environment affects economic outcomes adversely (Alesina *et al.* 1996) and it may well be argued that a bad economic situation can cause political unrest. As one form of political instability, the threat of secession may be driven and fuelled by a country's economic situation. Public debt brings adverse consequences on a country's future economic position. As such, it may be seen as a catalyst for secessionism rather than a potential pacifier. This chapter establishes an opposite argument. It delves into the micro foundations behind the possibility of secession and identifies a strategic mechanism through which debt works in the direction of preventing separation rather than facilitating it.

The strategic mechanism identified in this chapter works through the effect of debt on the seceding region's potential gain from independence. If the gain from independence is decreasing in debt, then by issuing higher levels of debt the national government in effect sets up stronger constraints on the economic environment that the seceding region will inherit if it eventually becomes an independent state. Once debt reaches a sufficient level, the seceding region will find it more beneficial to stay united with the country than to separate from it.

This mechanism works under a key assumption that per capita burden of debt must remain the same whether secession takes place or not. Public debt is a liability which has to be paid back in full regardless of the decision on secession. This simplifying assumption is made because the variable of interest in this chapter pertains to the *level* of debt and not the *allocation* of debt. It rules out possible instances where secession is motivated by the prospect of lowering a region's *share* of the debt burden. Rather, it maintains that the prospect of secession is driven by a fundamental reason, difference in preferences.

Essentially, this chapter postulates that, given the conditions identified herein, the threat of secession creates a tendency for a country to issue debt in an attempt to stabilize itself. It formalizes one observation, with specific application on debt policy:

> "Any state that seeks to avoid its own dissolution would have an incentive to implement policies designed to prevent groups from becoming *prosperous enough*..."
> –Allen Buchanan, *Theories of Secession*

In this theoretical model, I consider a country where two regions differ in terms of preferences for two publicly-provided private goods. With a democratic setup, the majority region in this country is decisive over the level and composition of public spending. The minority region issues a threat of secession in order to obtain independence in making policy choices for its own jurisdiction. I consider the subgame perfect equilibrium and identify conditions under which public debt can be used to preserve the union at the equilibrium outcome.

The central finding in this chapter is that public debt can be a strategic instrument in preventing separation if the seceding region's potential gain from independence is decreasing

in debt. When the seceding region's potential gain from independence is decreasing in debt, the majority region may consider issuing higher levels of debt for the strategic purpose of preventing separation.

The rest of the chapter is organized as follows. Section 1.2 relates this model with the existing literature on debt and secession. Section 1.3 describes the model and its assumptions. Section 1.4 considers a benchmark case where the threat of secession is absent. Section 1.5 analyzes the minority region's decision when there exists a possibility of secession. Section 1.6 describes the majority region's optimal choice. Section 1.7 characterizes the equilibrium. The chapter ends with a conclusion in Section 1.8.

1.2 Related literature

The secession decision is usually characterized as a tradeoff between economies of scale and diversity in preferences. This chapter focuses on difference in preferences as a motivation behind the option of secession and incorporates the loss in economies of scale into the costs of separation. Alesina and Spolaore (1997) develop a model where an individual's utility is decreasing with the distance between the actual type of government and his "ideal government." They show that there is an excess tendency towards separation. They pointed out that democratization and increasing market integration are both associated with political separatism (also in Alesina, Perotti and Spolaore 1995; Alesina and Spolaore 2005). By removing barriers to trade, economic integration reduces the benefit of scale economies for large countries and opens up a wider market for small countries if they decide to form separate states.[1]

Bolton and Roland (1997) model the secession decision as a tradeoff between the efficiency gains of keeping a union and the benefits of having a redistribution policy closer to the preferences of each region. The motivation to secede is driven by differences in income distribution across regions, which give rise to differences in the preferred tax rate. They show that secession can be prevented by setting an accommodating tax rate that is closer to the preferred tax rate of the seceding region than the tax rate set in the absence of such a threat. My model differs

[1] Also in Casella 1992; Alesina, Spolaore and Wacziarg 2000; Casella and Feinstein 2002; Ruta 2005.

from Bolton and Roland in two ways. First, the motivation to secede in this model is driven by difference in preferences without regard to difference in income distribution. Second, it shows that secession can be prevented without the use of accommodating policies.

The existing literature on the prevention of separation carries a general consensus that the majority must adjust national policies towards making them more favorable for the minority group threatening to secede. This policy compromise should be sufficient to keep the minority satisfied, thus preventing them from separating. Le Breton and Weber (2003) demonstrate that secession can be prevented by designing a transfer scheme sufficient to keep the minority region region satisfied if it remains with the union[2]. According to Buchanan and Faith (1987), the mere possibility of separation influences the behaviour of governments towards such a way that they would not otherwise behave in the absence of a secession threat. More specifically, if secession exists as a legal right, it restricts the potential exploitation level of those in office by imposing a limit on their taxation capacity. Their model treats taxation as a form of extraction where the rents are distributed among a "sharing coalition" and are exclusive from the rest of the society. They show that if the citizens outside of this sharing coalition have an option to withdraw from the state, the potential rents become limited.

On a similar note, Anesi (2012) demonstrates how a secessionist threat leads to more favorable policies for the minority group. He uses a model that introduces uncertainty on the economic benefits of integration and the consequences of secession. The majority has information advantage over the minority and this asymmetry of information leads to the inevitability of secession. Anesi shows that secession can be prevented only if the ruling majority precommits to minority protection rules. Olofsgard (2003) shows that information asymmetry provides a platform for the electorate to vote for a separatist party through whom they can extract a larger transfer from the central government.

Anesi and De Donder (2013) identify three general categories of responses to separatist tension – one, a policy compromise to prevent the minority region from seceding; two, fighting separatist movements resulting in violent conflict; three, accepting demands leading to peaceful

[2] Also in Haimanko *et al.* 2005.

separation. As in most models, they imply that peaceful prevention of separation involves terms which favor the minority. Radan (2007) documents differences between peaceful secessions and violent secessions and notes that peaceful secessions are usually characterized with the national government's willingness to let go of the secessionist group with minimal or no resistance. If the national government is not willing to let the minority region attain its own independence while the latter insists on separating, it can be predicted that war would ensue.

This chapter diverges from the existing literature by describing an instrument in preventing secession which involves neither armed conflict nor compromise. It describes a third alternative using public debt, a burden which has to be carried by both sides. This alternative creates efficiency costs for both the national government and the seceding region but it does not involve resorting to war.

The idea that public debt can be used as a strategic variable to influence the action of future decision makers is well established in other contexts. Tabellini and Alesina (1990) show that there is a tendency to issue debt as a commitment device that shapes future policy towards the direction which current decision makers favor. Their model identifies two countervailing forces – the "level effect" of debt and the "desired composition effect." The "level effect" raises the total level of consumption in the current period while the "desired composition effect" restricts future consumption towards the composition that the current policy maker prefers. If the "desired composition effect" dominates the "level effect," the incumbent is inclined to issue debt in order to tie the hands of its successor. The commitment effect of debt is echoed in similar models by Persson and Svensson (1989) and Alesina and Tabellini (1990).[3]

The idea in this chapter is most similar to the model of Aghion and Bolton (1990) who show that there is a tendency to issue a high level of debt in order for a ruling party to remain in power. Their model introduces an endogenous election outcome and allows for the possibility of debt default. They describe a tendency for the incumbent to create debt as a *strategic inefficiency* in the sense that it can be used by the ruling party to remain in office

[3] A comprehensive literature review on the political economy of budget deficits can be found in Alesina and Perotti (1995).

yet it carries efficiency costs for the whole country.[4]

In this chapter, I describe debt as a *strategic inefficiency* in the context of secession. A high level of public debt can be issued in order to prevent secession, thus keeping the same decision maker in place. In contrast to Aghion and Bolton, the vote is made on whether one region will separate or stay with the country and not on which political party wins the national elections. If the region decides to secede, the power to make decisions for this region is shifted to another ruler overseeing the new, independent government. If it decides to stay, the national decision maker keeps the authority to choose policies involving this region.

1.3 The model

Consider a two-period model with one country consisting of two regions, A and B, whose population sizes are η_A and η_B, respectively. Without loss of generality, let $\eta_A > \eta_B$. Region A is referred to as the majority region while region B is considered the minority region. The utility of each citizen is defined over the consumption of two publicly provided private goods, x and y. Citizens within each region have homogeneous preferences. The utility of a citizen in region i can be represented as:

$$U_i = \sum_{t=1}^{2} \left[u_i(x_t) + v_i(y_t) \right], \ i = A, B \tag{1.1}$$

where x_t and y_t are per capita levels of x and y, respectively, chosen by the government in period $t = 1, 2$. The price of each good is normalized to 1.

Citizens of the two regions have different preferences for x and y in the sense that

$$u'_A(x_t) > u'_B(x_t), \ \forall x_t > 0 \tag{1.2}$$

$$v'_A(y_t) < v'_B(y_t), \ \forall y_t > 0 \tag{1.3}$$

where $u'_i(x_t) > 0$, $u''_i(x_t) < 0$ and $v'_i(y_t) > 0$, $v''_i(y_t) < 0$ for $i = A, B$. In this case, region A

[4] Similar ideas are also described in other models with endogenous election outcomes (Milesi-Ferretti and Spolaore 1994; Milesi-Ferretti 1995).

has a stronger preference for good x than region B, while region B has a stronger preference for good y than region A.[5]

In period 1, the country is organized as one democractic decision-making unit and under the assumption of majority voting rule, citizens in the majority region are decisive over the levels of consumption, x_1 and y_1. The country faces the following budget constraint:

$$x_1 + y_1 \leq 1 + d \tag{1.4}$$

where per capita output endowment is fixed and normalized to 1 and $d \in [-1, \widehat{d}]$ is the per capita level of public debt that the country can choose to incur in period 1. This debt will have to be fully repaid in period 2 so d cannot exceed a maximum amount $\widehat{d} = \min\{1-c, 1-k\}$. This model assumes zero discounting and refers to public debt as a small country government's net borrowing from abroad. As such, this external debt cannot affect the world interest rate which is set equal to 0.

If the country remains united in period 2, the majority region remains decisive over the level and composition of spending, x_2^N and y_2^N. The country as a whole will face the following budget constraint in period 2:

$$x_2^N + y_2^N \leq 1 - d. \tag{1.5}$$

If secession takes place, region B will obtain the right to choose its own levels of consumption in period 2, x_2^B and y_2^B. It will incur a cost of separation per capita equal to $k \in (0, 1)$. This cost accounts for the fact that a new independent state will have to institute systems necessary for its own governance and the conduct of its own affairs. These systems include but are not limited to the formation of its own national defense, international relations and general administration. Thus, region B will face the following budget constraint as an independent state:

$$x_2^B + y_2^B \leq 1 - d - k. \tag{1.6}$$

[5] The analytical results of this chapter are preserved if the difference in preferences is modelled in terms of relative preferences rather than absolute preferences.

On the other hand, region A's citizens will have to choose their own levels of consumption x_2^A and y_2^A in the secession scenario. Region A will incur its own cost of separation per capita equal to $c \in (0,1)$. This cost pertains to the loss in economies of scale resulting from the fact that the fixed costs of running the country will be shared by a fewer number of citizens, resulting to an increase in the burden per capita.[6] Thus, region A's own budget constraint is given by

$$x_2^A + y_2^A \leq 1 - d - c \tag{1.7}$$

It is crucial to make the neutrality assumption that per capita burden of debt in period 2 remains fixed once it is set in period 1 and each citizen will have to carry the same amount of liability whether secession takes place or the union remains intact. This assumption is necessary in order to keep the allocation of debt burden from contaminating the motivation to secede. It isolates the effect of difference in preferences between the two regions on the possibility of secession. For this reason, it is assumed that the share of debt burden per capita is equal to 1 for each citizen in each region under both union and secession.[7]

The model is a dynamic game with complete information and I am interested in the subgame perfect Nash equilibrium (SPNE) in pure strategies. The sequence of the game is organized as follows and illustrated in Figure 1.1.

[6] The per capita cost of separation for each region may represent other losses associated with leaving a union. These losses include foregone benefits from a union like interregional transfers (if the region is a net recipient of transfers) and the market size for domestic products (in a world of less than perfect international trade). These losses consist as well of the costs involved in the process of undergoing separation.

[7] If I relax this assumption and allow the minority region to carry less than its full share of per capita debt burden, the analytical results of this chapter continue to hold as long as its share is sufficiently large. Moreover, if the minority region carries per capita debt burden larger than 1, then in this case the analytical findings of this chapter remain intact.

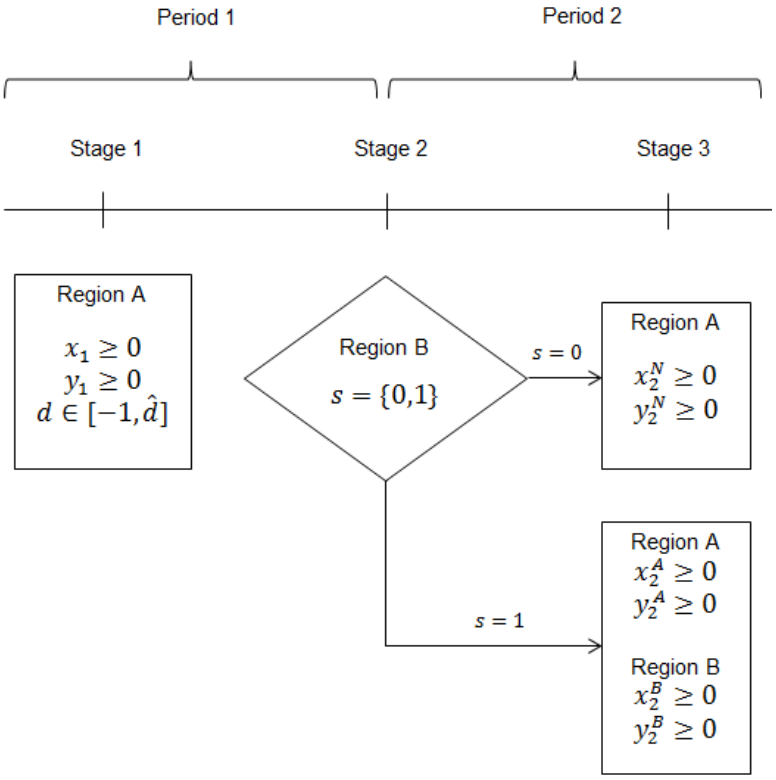


Figure 1.1. Sequence of the game

In period 1, region A chooses per capita consumption levels (x_1, y_1) as well as per capita debt level $d \in [-1, \widehat{d}]$ for the whole country. This set of choices comprises stage 1. Upon observing (x_1, y_1) and d, region B decides in stage 2 whether it will stay united with the country $\{s = 0\}$ or it will secede to form an independent state $\{s = 1\}$. If it chooses $s = 0$,then at stage 3 region A will choose period 2 consumption levels $\left(x_2^N, y_2^N\right)$ subject to (1.5). If, on the other hand, region B chooses $s = 1$, then at stage 3 each region $i \in \{A, B\}$ independently chooses its consumption levels $\left(x_2^i, y_2^i\right)$, given the budget constraints (1.7) and (1.6), respectively.

The minority region's utility level in period 2 can be described as:

$$U_{B,2} = \left\{ \begin{array}{l} u_B(x_2^N) + v_B(y_2^N), \text{ if } s = 0 \\ u_B(x_2^B) + v_B(y_2^B), \text{ if } s = 1 \end{array} \right\}.$$

The majority region's utility in the last period is given by:

$$U_{A,2} = \left\{ \begin{array}{l} u_A(x_2^N) + v_A(y_2^N), \text{ if } s = 0 \\ u_A(x_2^A) + v_A(y_2^A), \text{ if } s = 1 \end{array} \right\}.$$

Finally, I assume the tie-breaking rule that region B chooses $s = 0$ (the union) if its period 2 utility levels under both scenarios are exactly the same.[8]

1.4 Equilibrium without threat of secession

Consider a benchmark case where there is no threat of secession. For this case, region A will choose the optimal consumption levels (x_1^{*N}, y_1^{*N}) for period 1 and (x_2^{*N}, y_2^{*N}) for period 2 that maximize its total utility (1.1) subject to the budget constraints (1.4) and (1.5). Its total payoff is given by

$$U_A^N = u_A(x_1^{*N}) + v_A(y_1^{*N}) + u_A(x_2^{*N}) + v_A(y_2^{*N}).$$

The optimal consumption levels must satisfy the following first-order condition (FOC):

$$u'_A(x_1^{*N}) = v'_A(y_1^{*N}) = u'_A(x_2^{*N}) = v'_A(y_2^{*N}),$$

which, in line with the consumption smoothing argument by Barro (1979), implies that

$$x_1^{*N} = x_2^{*N}$$

$$y_1^{*N} = y_2^{*N} \Rightarrow 1 + d^* - x_1^{*N} = 1 - d^* - x_2^{*N}.$$

This can be satisfied if and only if

$$d^* = 0.$$

[8] In order to focus on the effect of debt as a strategic instrument in preventing secession, this model also assumes that the majority region cannot credibly commit to other forms of preemptive mechanisms such as interregional transfers and accommodating policies for the minority region. These are instruments already described in the existing literature on secession.

Thus, at the equilibrium where there is no threat of secession, the optimal level of debt is equal to zero.

1.5 Equilibrium with threat of secession

Consider now the game with a threat of secession. To express region B's motivation to entertain the possibility of seceding, this game assumes that at $d = 0$, region B's period 2 utility level under secession is higher than its period 2 utility level under the union:

$$U_{B,2}(s = 1, d = 0) > U_{B,2}(s = 0, d = 0). \tag{a}$$

To see whether issuing a specific amount of debt can influence the minority region's decision on secession, I solve the game by backward induction. At stage 3, the subgame depends on whether region B chooses $s = 0$ or $s = 1$ in stage 2.

If $s = 0$, the subgame at stage 3 is characterized by public provision of private goods at levels x_2^{*N} and y_2^{*N} which maximize region A's period 2 utility

$$U_{A,2}^N = u_A(x_2^N) + v_A(y_2^N)$$

subject to

$$x_2^N + y_2^N \leq 1 - d,$$

for any given debt level d chosen in stage 1 of the game. Using that

$$y_2^{*N} = 1 - d - x_2^{*N},$$

the consumption levels (x_2^{*N}, y_2^{*N}) satisfy the following FOC:

$$u'_A(x_2^{*N}) = v'_A(1 - d - x_2^{*N}). \tag{1.8}$$

Thus, region B's payoff in this outcome at stage 3 is given by

$$U_{B,2}(s=0,d) = u_B(x_2^{*N}) + v_B(1-d-x_2^{*N}), \tag{1.9}$$

for any given level of debt d.

If $s=1$, the subgame at stage 3 for region B is characterized by public provision of private goods at levels x_2^{*B} and y_2^{*B} which maximize region B's period 2 utility

$$U_{B,2}^S = u_B(x_2^B) + v_B(y_2^B)$$

subject to the minority region's budget constraint,

$$x_2^B + y_2^B \leq 1 - d - k,$$

for any given level of debt d set by region A in period 1. Using that

$$y_2^{*B} = 1 - d - k - x_2^{*B},$$

the consumption levels (x_2^{*B}, y_2^{*B}) satisfy the following FOC:

$$u_B'(x_2^{*B}) = v_B'(1-d-k-x_2^{*B}). \tag{1.10}$$

Thus, region B's payoff in this outcome at stage 3 is given by

$$U_{B,2}(s=1,d) = u_B(x_2^{*B}) + v_B(1-d-k-x_2^{*B}), \tag{1.11}$$

for any given level of debt d.

At stage 2, region B's option $s=1$ dominates $s=0$ if and only if

$$U_{B,2}(s=1,d) > U_{B,2}(s=0,d). \tag{1.12}$$

As a result of the assumptions on preferences represented in (1.2) and (1.3), the optimal bundles of consumption in the two subgames differ in such a way that region B will always choose a lower consumption of x_2 if it decides to secede,

$$x_2^{*N} > x_2^{*B},$$

while there are two possible directions for y_2. On one hand, region B prefers a higher consumption of y_2 compared to region A. On the other hand, the cost of secession k entails that region B's consumption of y_2 as an independent state may be lower than its consumption in a union. The first possibility dominates the second possibility, that is,

$$y_2^{*B} > y_2^{*N}, \tag{1.13}$$

if and only if k is sufficiently small:

$$k < x_2^{*N} - x_2^{*B}. \tag{b}$$

One necessary condition for region B to consider a threat of secession is for (1.13) to be satisfied. Thus, the possibility of secession is a credible threat only if (b) holds.

1.5.1 The relationship between debt and preference mismatch

In a united situation, the majority region imposes its preferences on the minority region and allocates per capita income on the two publicly-provided private goods while applying its own consumption preferences. This implies that citizens in the minority region cannot make the best use of their income and, for a given income level, they suffer a utility loss compared to the optimal use of this income. In this section, I study how this utility loss changes with a change in per capita debt level, which is effectively a unit reduction in income. In order to establish this I need the following notation:

Definition 1 *Let* $\Delta \equiv U_{B,2}(s=1,d) - U_{B,2}(s=0,d)$ *be defined as region B's potential "gain*

from independence" or, equivalently, region B's utility loss associated with staying in the union, for any given level of debt d.

Region B optimally chooses $s = 1$ in stage 2 if $\Delta > 0$ and $s = 0$ if $\Delta \leq 0$. Substituting (1.9) and (1.11) into *Definition* 1, Δ can be expressed in terms of d as:

$$\Delta = u_B(x_2^{*B}) + v_B(1 - d - k - x_2^{*B}) - u_B(x_2^{*N}) - v_B(1 - d - x_2^{*N}). \tag{1.14}$$

Assumption 1. Δ is monotonically declining in d.

With *Assumption 1*, I consider the minority region's decision in stage 2 on whether to separate or not. This decision can be charaterized as follows.

Proposition 1 *Suppose* (a) *holds and Assumption* 1 *is satisfied. Then there exists a unique threshold debt level* $\overline{d} \in (0, 1 - k)$ *such that region B's optimal choice at stage 2 is* $s^* = 0$ *if and only if* $d \geq \overline{d}$.

Proof. First note that Δ is continuous in d everywhere, by the continuity of $u_i(x_t)$ and $v_i(y_t)$. $\Delta(d = 0) > 0$ if (a) holds. By *Assumption* 1, Δ is monotonically declining in d. At $d = 1 - k$, $\Delta < 0$ since $x_2^{*B} = 0$ and $y_2^{*B} = 0$ for $s = 0$ while $x_2^{*N} \geq 0$ and $y_2^{*N} \geq 0$ with at least one equation being a strict inequality for $s = 1$. The assumptions $u_i'(x_t) > 0$ and $v_i'(y_t) > 0$ ensure that $U_{B,2}(s = 1, d = 1 - k) = u_B(0) + v_B(0) < U_{B,2}(s = 0, d = 1 - k) = u_B(x_2^{*N}) + v_B(y_2^{*N})$. Hence, by the Intermediate Value Theorem, there exists a unique level of debt $\overline{d} \in (0, 1 - k)$ satisfying $\Delta(\overline{d}) = 0$. ■

Region B's decision whether to stay together with region A or to separate follows a threshold rule. There is exactly one level of debt $\overline{d}$ that makes region B indifferent about whether to secede or not. For levels of debt exceeding this threshold, region B prefers to stay in the union, and for levels of debt below this threshold, region B prefers to separate. This condition determines the non-separation constraint (NSC), by which region B chooses $s^* = 0$ in stage 2

if region A sets debt level d in stage 1 such that

$$d \geq \overline{d}. \tag{c}$$

Figure 1.2 illustrates that if the potential gain from independence is monotonically decreasing in debt, region B will always prefer to stay in the union once debt crosses the threshold level $\overline{d}$.

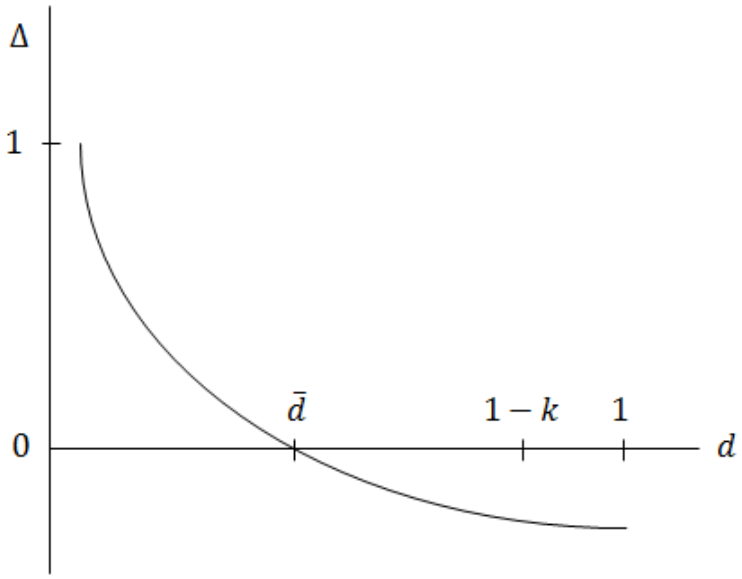


Figure 1.2. Potential gain from independence as a function of the debt level

1.5.2 An example

With the following example, I show that *Assumption 1* is satisfied and illustrate that there exists a threshold level of debt $\overline{d}$ which can be used to prevent the minority region from seceding.

Let $U_A = \sum_{t=1,2} \left[\beta\sqrt{x_t} + \sqrt{y_t}\right]$ and $U_B = \sum_{t=1,2} \left[\sqrt{x_t} + \gamma\sqrt{y_t}\right]$, where $\beta, \gamma > 1$. This example satisfies the model assumptions in (1.2) and (1.3). If the country remains united in

period 2, the consumption levels of x and y that region A will choose for the country are given by

$$x_2^{*N} = \frac{\beta^2}{\beta^2+1}(1-d), \quad y_2^{*N} = \frac{1}{\beta^2+1}(1-d).$$

On the other hand, if region B decides to secede, its period 2 consumption levels will be equal to

$$x_2^{*B} = \frac{1}{\gamma^2+1}(1-d-k), \; y_2^{*B} = \frac{\gamma^2}{\gamma^2+1}(1-d-k).$$

Region B's potential gain from independence is given by

$$\Delta = \sqrt{\frac{1}{\gamma^2+1}(1-d-k)} + \gamma\sqrt{\frac{\gamma^2}{\gamma^2+1}(1-d-k)} - \sqrt{\frac{\beta^2}{\beta^2+1}(1-d)} - \gamma\sqrt{\frac{1}{\beta^2+1}(1-d)}.$$

The effect of debt on Δ, $\frac{d\Delta}{dd}$, is strictly negative if

$$\frac{(\beta+\gamma)^2}{(\gamma^2+1)(\beta^2+1)} < \frac{1-d}{1-d-k},$$

a condition that is always satisfied given that $\beta, \gamma > 1$ and $k > 0$. Thus, in this example, region B's potential gain from independence is monotonically decreasing in debt. By *Proposition* 1, there exists a unique threshold level of debt $\overline{d}$ such that region B will choose to stay in the union if region A sets the public debt level $d \geq \overline{d}$. This threshold level $\overline{d}$ is given by

$$\overline{d} = 1 - Mk \tag{1.15}$$

where

$$M \equiv \frac{\left(1+\gamma^2\right)^2\left(\beta^2+1\right)}{\left(1+\gamma^2\right)^2\left(\beta^2+1\right) - (\beta+\gamma)^2(\gamma^2+1)}. \tag{1.16}$$

1.6 The decision of the majority region

In this section, I examine the majority region's equilibrium choice of public debt. Using backward induction, I first describe region A's total payoff at the end of the game for any

given level of debt d that it sets in period 1.

Region A enters one of two possible subgames at stage 3. If region B chooses $s = 0$ at stage 2, then region A enters the non-secession subgame at stage 3. In this subgame, region A chooses the consumption levels for periods 1 and 2 that maximize its total utility (1.1) subject to the budget constraints (1.4) and (1.5) and the non-separation constraint in (c). Let λ be the Lagrange multiplier for the inequality constraint (c). This constraint is binding so $\lambda > 0$ and the optimal consumption levels $\left(\overline{x}_1^{*N}, \overline{y}_1^{*N}, \overline{x}_2^{*N}, \overline{y}_2^{*N}, \right)$ satisfy the FOCs:

$$u'_A(\overline{x}_1^{*N}) = v'_A(\overline{y}_1^{*N}) = u'_A(\overline{x}_2^{*N}) - \lambda = v'_A(\overline{y}_2^{*N}) - \lambda$$

and

$$d = \overline{d}.$$

These conditions are satisfied simultaneously by the optimal choice of debt,

$$d^{*N} = \overline{d}$$

Thus, region A's total payoff in this subgame is equal to

$$U_A^*(s = 0, d^{*N} = \overline{d}) = u_A(\overline{x}_1^{*N}) + v_A(\overline{y}_1^{*N}) + u_A(\overline{x}_2^{*N}) + v_A(\overline{y}_2^{*N}). \tag{1.17}$$

If region B chooses $s = 1$ at stage 2, then region A enters the secession subgame at stage 3. In this subgame, region A chooses the consumption levels for periods 1 and 2 that maximize its total utility (1.1) subject to budget constraints (1.4) and (1.7). The optimal consumption levels $\left(x_1^{*S}, y_1^{*S}, x_2^{*A}, y_2^{*A}\right)$ satisfy the FOC:

$$u'_A(x_1^{*S}) = v'_A(y_1^{*S}) = u'_A(x_2^{*A}) = v'_A(y_2^{*A}).$$

Thus,

$$x_1^{*S} = x_2^{*A}$$

$$y_1^{*S} = y_2^{*A} \Rightarrow 1 + d - x_1^{*S} = 1 - d - c - x_2^{*A}.$$

Region A's optimal choice of debt in this subgame is

$$d^{*S} = -\frac{c}{2}.$$

Region A should *save* in period 1 in order to smooth its consumption over the two periods. Its total payoff in this subgame is

$$U_A^*(s = 1, d^{*S} = -\frac{c}{2}) = u_A(x_1^{*S}) + v_A(y_1^{*S}) + u_A(x_2^{*A}) + v_A(y_2^{*A}). \tag{1.18}$$

The subgame perfect Nash equilibrium of this game depends on whether

$$U_A^*(s = 0, d^{*N} = \overline{d}) \geq U_A^*(s = 1, d^{*S} = -\frac{c}{2}) \tag{e}$$

or not.

1.7 The optimal debt and secession decisions

Taking together the optimal decisions of regions A and B at each stage of the game, I now characterize the subgame perfect Nash equilibrium. I show that generically, this game has a unique equilibrium. This equilibrium can be one of two types: one where region A issues a specific level of debt sufficient to keep region B from separating and another where region A chooses to keep savings in period 1 and region B decides to secede at stage 2. When conditions that support the first type of equilibrium are fulfilled, public debt acts as a strategic instrument in preserving the union. Otherwise, secession occurs.

Proposition 2 *Suppose* $\frac{d\Delta}{dd} < 0$. *If* (e) *holds, then in the subgame perfect equilibrium region A sets* $d^* = \overline{d}$ *and region B optimally chooses* $s^* = 0$. *Otherwise, if* (e) *does not hold, then in the subgame perfect equilibrium region A sets* $d^* = -\frac{c}{2}$ *and region B optimally chooses* $s^* = 1$.

Proof. By backward induction, region A sets $d^* = \overline{d}$ at stage 1 if and only if (e) holds. By *Proposition* 1, region B chooses $s^* = 0$ at stage 2 if $d \geq \overline{d}$, given $\frac{d\Delta}{dd} < 0$. On the other hand, if (e) does not hold, then by backward induction, region A sets $d^* = -\frac{c}{2}$ at stage 1. Because $d^* = -\frac{c}{2}$ does not satisfy the non-separation constraint expressed in (c), then at stage 2 region B chooses $s^* = 1$. ■

Proposition 2 implies that, for the union to be preserved using public debt, region A must be better off in a union with debt $\overline{d}$ than as a separate state with savings equal to half of its own separation cost.

To illustrate the tradeoff in (e), I revisit the parametrization of utility in the previous example and characterize the equilibrium as follows.

1.7.1 Example

Given $U_A = \sum_{t=1,2} \left[\beta\sqrt{x_t} + \sqrt{y_t}\right]$, region A has the option to set $d^{*N} = \overline{d}$ and obtain consumption levels in periods 1 and 2 equal to

$$\overline{x}_1^{*N} = \frac{\beta^2}{1+\beta^2} + \frac{\beta^2}{1+\beta^2} \cdot \overline{d}, \quad \overline{y}_1^{*N} = \frac{1}{1+\beta^2} + \frac{1}{1+\beta^2} \cdot \overline{d}$$

$$\overline{x}_2^{*N} = \frac{\beta^2}{1+\beta^2} - \frac{\beta^2}{1+\beta^2} \cdot \overline{d}, \quad \overline{y}_2^{*N} = \frac{1}{1+\beta^2} - \frac{1}{1+\beta^2} \cdot \overline{d}.$$

In this case, region A will end up with total payoff

$$U_A^*(s=0, d^{*N} = \overline{d}) = \beta\sqrt{\overline{x}_1^{*N}} + \sqrt{\overline{y}_1^{*N}} + \beta\sqrt{\overline{x}_2^{*N}} + \sqrt{\overline{y}_2^{*N}}. \tag{1.19}$$

On the other hand, if region A sets $d^{*S} = -\frac{c}{2}$, its optimal consumption bundle for periods 1 and 2 is given by

$$x_1^{*S} = \frac{\beta^2}{1+\beta^2} - \frac{\beta^2}{2+2\beta^2} \cdot c, \quad y_1^{*S} = \frac{1}{1+\beta^2} - \frac{1}{2+2\beta^2} \cdot c$$

$$x_2^{*A} = \frac{\beta^2}{1+\beta^2} + \frac{\beta^2}{2+2\beta^2} \cdot c, \quad y_2^{*A} = \frac{1}{1+\beta^2} + \frac{1}{2+2\beta^2} \cdot c$$

Its total payoff by the end of this game is characterized as:

$$U_A^{*S}(s=1, d^{*S} = -\frac{c}{2}) = \beta\sqrt{x_1^{*S}} + \sqrt{y_1^{*S}} + \beta\sqrt{x_2^{*A}} + \sqrt{y_2^{*A}}. \tag{1.20}$$

Region A will optimally choose to preempt secession using debt if (e) holds. Plugging in the payoffs (1.19) and (1.20) into (e), I find that in this example, region A will optimally choose to preserve the union as long as the threshold debt level is sufficiently small:

$$\overline{d} \leq \frac{c}{2}. \tag{1.21}$$

With the threshold debt level $\overline{d}$ given by (1.15), region A uses debt in equilibrium if and only if

$$c \geq 2 - 2Mk.$$

Figure 1.3 illustrates the equilibrium in this example for given costs of separation, c and k. In this figure, $\overline{k} = x_2^{*N} - x_2^{*B}$ represents the dividing line between a credible threat of secession and the benchmark case where there is no threat of secession.

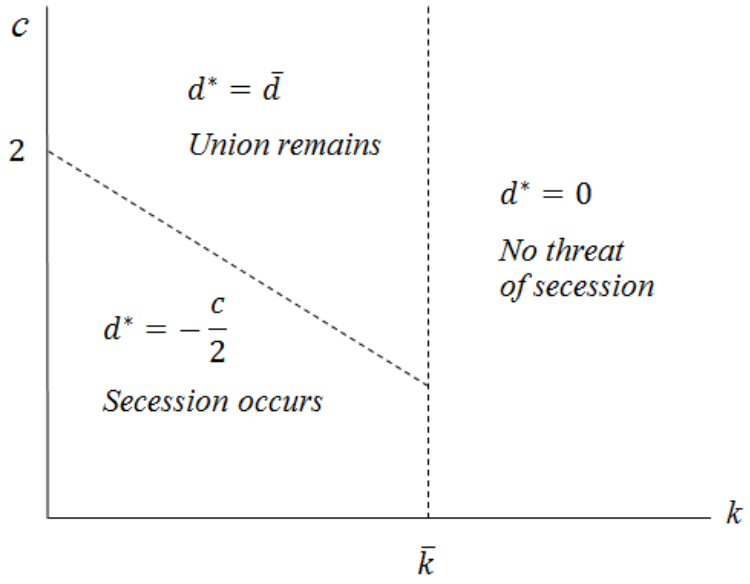


Figure 1.3. Equilibrium at given levels of separation costs, c and k

1.7.2 Comparative statics

Consider an increase in c holding all other variables fixed. Region A's utility as a separate state with savings shifts downwards, i.e., $U_A^*(s = 1, d^{*S} = -\frac{c}{2})$ is smaller, if c is higher. The right-hand side of (e) decreases if c increases. Thus, a subgame perfect equilibrium in which the union is preserved using public debt $(s^* = 0, d^* = \overline{d})$ is supported by high costs of separation for region A.

Now consider the effect of a marginal change in k, holding all other variables fixed. Region B's cost of separation k affects the subgame perfect equilibrium through its effect on the threshold debt level $\overline{d}$. Region A's utility under the union is (weakly) decreasing in $\overline{d}$ because if a higher threshold level of debt is needed to prevent secession, the intertemporal distortion arising from consumption unsmoothing will also be higher. The left-hand side of (e) weakly decreases as $\overline{d}$ increases. However, $\overline{d}$ is decreasing in region B's cost of separation k. Higher values of k are associated with lower levels of $\overline{d}$ because less debt is necessary to match the low

benefits from independence that can be had when the cost of separation is high. Because lower levels of $\overline{d}$ translate into higher utility for region A in a united situation, the overall effect of k on the union's preservation is positive. A higher cost of separation for region B supports a subgame perfect equilibrium where the union is saved using debt as a strategic instrument.

1.8 Conclusion

This chapter demonstrates that public debt can be used as a strategic instrument in preventing secession. This argument differs from the notion that a high level of government debt intensifies the possibility of separation and adds to political instability in general. While this chapter does not discount this notion, it establishes that there is a strategic mechanism through which the effect of debt acts in the direction of preserving a country's unity.

This counter-intuitive argument is brought forth by identifying micro foundations behind the decision on secession. Difference in preferences is recognized as the fundamental basis behind a minority region's possibility of calling for independence. The potential gain from independence that this region can achieve through secession arises from utility gains in choosing consumption bundles according to its own preference. This chapter specifies that the potential gain from independence may be affected by debt. More specifically, the potential gain from independence can be monotonically decreasing in debt.

The property of decreasing gain from independence is central in this argument. If this property holds, then by raising the debt level the national government can influence the minority region's decision on secession because higher debt levels leave the seceding region with lesser gains from leaving the union. This chapter proves that the debt level can be set high enough to induce the minority region to stay in the union.

Given that the gain from independence is decreasing in debt, it is in the best interest of the majority region to set public debt at a strategically high level and thus preempt secession if it finds itself better off in a united country carrying this debt than as a separate state with some savings. This is more likely the case if its own cost of separation is high.

The issuance of public debt for the purpose of preventing secession makes it a *strategic*

inefficiency. It is *inefficient* in the sense that it distorts the intertemporal path of public spending and creates efficiency costs in doing so. Nonetheless, it is *strategic* in the sense that it can influence the secession outcome towards preserving a country's unity. The findings of this chapter imply that the very existence of a secession threat may create a tendency for the country to set an inefficiently high level of debt for the strategic purpose of keeping itself intact.

Chapter 2

The Economic Cost of Secessionist Conflict in the Philippines

2.1 Introduction

The direct and immediate consequence of armed conflict manifests itself in the loss of lives, injuries, damage to property, disruption of normal affairs, and threat to security. Such effects are observable when a struggle for secession turns into a violent conflict. However, the effect of such a conflict on national income is not directly observable even if the country's income before and during the conflict can be observed. This is because the effect must be measured as the difference between actual income during the conflict and counterfactual income of the country if the conflict did not take place. The counterfactual levels of income during the period of secessionist conflict are not reported in national accounts. This chapter uses the synthetic control method to estimate these counterfactual levels and measure the economic cost of secessionist conflict in the Philippines.

This chapter finds that the counterfactual income of the Philippines can be measured as a weighted combination of the income levels of four developing countries unexposed to secessionist conflict during the period of interest: Thailand, the Dominican Republic, Fiji and Zambia. This weighted combination of countries comprises a synthetic Philippines against which the Philippines' actual income levels can be compared. As the synthetic Philippines is not exposed to secessionist conflict, the effect of such a conflict on the Philippines' national income can be measured as the difference between the Philippines' actual income during the

conflict period and the counterfactual income of the synthetic Philippines during the same time period.

Estimates show that the Philippines' actual income began to diverge from its counterfactual path as soon as the secessionist conflict began. Economic output of the country remained lower than the estimated income of the synthetic Philippines throughout the conflict period. This study estimates an *annual* economic cost averaging 400 US$ per capita during the first 10 years of the secessionist conflict. This is equivalent to 18% of the country's average real GDP per capita per year. As the conflict persisted through another 10 years, the average *annual* cost amounted to more than 800 US$, equivalent to 32% of the Philippines' average income per capita per year. By the third decade of the conflict, the *annual* cost averaged 1,600 US$ per capita. This opportunity cost is equivalent to 46% of the country's average annual income.

This study reveals a substantial economic cost of the secessionist conflict on the Philippines. Previous studies have focused on the direct costs of the conflict incurred during battle operations. For example, Buendia (2005) accounted that during the height of the civil conflict in the year 2000, approximately 10 million US$ worth of property and infrastructure were destroyed. He reported that at this time the Philippine army spent 1-2 million US$ a day for military operations on the war. However, studies on the total effect of the conflict on national income remain scarce due to measurement issues and difficulties in imputing values.

Schiavo-Campo and Judd (2005) estimated the "direct" annual economic cost of the conflict, which they define as output loss compared with the pre-conflict equilibrium, as 0.5% of the Philippines' GDP during the period 1975-1982. This was a period of high intensity in the armed conflict, and this was halfway along the first and second decades of the struggle. Their cost estimates for this period is roughly similar to their estimated economic cost for the end of the third decade. Throughout the whole period between 1970 and 2001, they impute the value of total direct output losses from the secessionist conflict to be around 2-3 billion US$. In addition, they include foregone investments in their estimates of "indirect" economic costs between 1975-2002 which they project to be more than 10 billion US$. To arrive at these estimates, they employed a cross-section regression analysis. These authors acknowledge

that their method of assigning values on output losses was subject to imperfect data on prices of goods and they had to rely on partial indicators of some outputs. I abstract from such limitations by using data on national income normalized in constant terms and adjusted for purchasing-power parity (PPP).

To my knowledge, this is the first study applying the synthetic control method to estimate the economic cost of secessionist conflict in the Philippines. By constructing a synthetic control group similar to the Philippines in many respects except for the presence of secessionist conflict, this study is able to track the consequence of this conflict on the Philippines. Other studies measuring the economic cost of conflict used regression analyses on other countries exposed to civil war (Collier 1999; Murdoch and Sandler 2002; Llussá and Tavares 2011). These quantitative studies used a cross section of countries to test the effect of conflict on those countries engaged in domestic warfare. They find significant negative correlations between conflict and the steady state levels of GDP per capita as well as private consumption and investment.

The empirical method I use in this chapter differs from previous studies on the cost of conflict in the Philippines and on the cost of civil conflict in general. The synthetic control method generates a causal effect as established in Abadie *et al.* (2010). By generating counterfactual levels of income in the absence of conflict, the effects estimated using the synthetic control method can be interpreted as a a result of the secessionist conflict itself.

The rest of the chapter is organized as follows. Section 2.2 gives a historical account of the secessionist conflict taking place in the Philippines. The empirical method for estimating the cost of this conflict is explained in Section 2.3. It is followed in Section 2.4 by a description of the data and selection of the sample used in this study. The results containing the estimated effects of the conflict are shown in Section 2.5. It also includes the results of a test which verifies the estimates. Section 2.6 gives a brief conclusion. The Appendix to this chapter contains a list of data sources.

2.2 Historical background of the secessionist conflict in the Philippines

The Philippine history is characterized with two lines of development that progressed in parallel. One is the outcome of Spanish and American rule for nearly four centuries that took place in majority of the country's present territory. The other line is governed by Muslim settlers with 500 years of political, economic and cultural history concentrated in the southern area called Mindanao (Bara 2011). For the most part of the western colonial period, these two lines of historical development remained largely disjoint. They involved different forms of government and ways of life following Christian and Muslim principles, respectively. In 1946, when the Philippines obtained freedom from foreign occupation, Mindanao was annexed as an official part of this independent nation.

In the 1950s, then President Ramon Magsaysay enforced a resettlement policy encouraging some Christians from the northern and central parts of the Philippines to move and build their livelihood in the southern island of Mindanao that is richly endowed with natural resources. This was an attempt at full integration of the country. However, this influx of immigrants resulted to unrest among the Muslim population who had originally settled in the area.

An incident known as the "Jabidah Massacre" in 1968 triggered insurgency among Muslims in Mindanao. At least 28 Moros recruited by the Philippine army were killed by army personnel during a training exercise. Outrage over this incident led to the formation of the Moro National Liberation Front (MNLF) in 1969, whose objective was to claim an independent state grounded on Islamic faith. The MNLF launched an organized Moro counter-offensive leading to armed conflict with the Philippine military. This resulted in casualties among the military, the separatists and civilian personnel.

Attempts at resolving the conflict involved several rounds of negotiations. In 1976, the MNLF and the Philippine government signed the Tripoli Agreement, which provides for autonomy in the Muslim-dominated areas of Mindanao. In March 1977, President Ferdinand Marcos declared autonomy in 13 provinces in Mindanao. Because the Philippine Constitution requires conducting a plebiscite before completely granting this autonomy, residents in

these 13 provinces underwent a voting stage in April 1977. The MNLF objected to the idea of conducting this plebiscite. In the end, only 10 provinces voted for autonomy so Marcos implemented autonomy on these 10 provinces instead of the full set of 13 provinces.

The MNLF was not satisfied with the implementation of the Tripoli Agreement so it reverted to its original claim of fighting for independent statehood for Muslim Mindanao. In 1984, a faction of the MNLF was formally established as the Moro Islamic Liberation Front (MILF). It engaged in more violent activities in its fight for secession.

In 1986, the Philippine government drafted a new Constitution that included provisions for autonomy in Muslim Mindanao. This Constitution was ratified in 1987 while the MNLF and MILF objected to those provisions regarding autonomy.

In 1989, President Corazon Aquino signed into law a republic act that establishes the Autonomous Region in Muslim Mindanao (ARMM). In order to determine which provinces to include in this autonomous region, a plebiscite followed while the MNLF and MILF objected to this voting stage. With this plebiscite, only four provinces – Lanao del Sur, Maguindanao, Sulu and Tawi-Tawi – opted for autonomy. These four provinces are marked **light gray** in the map of Mindanao illustrated in Figure 2.1, representing the ARMM established in 1989.

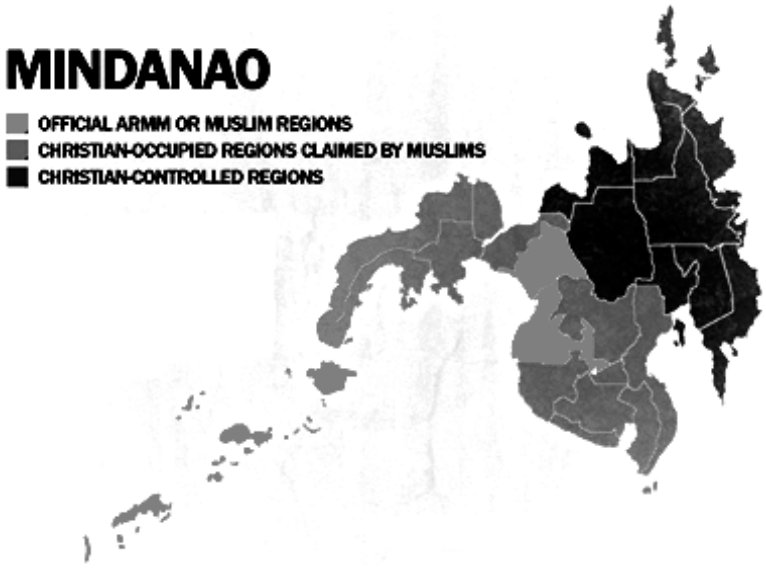


Figure 2.1. Map of Mindanao

The secessionists continue to claim other parts of Mindanao which are inhabited by a mix of Muslim descendants and Christian resettlers. The areas marked **dark gray** in Figure 2.1 represent the provinces under contention in this separatist conflict. To date, this threat of secession remains unresolved.

2.3 The synthetic control method for estimating the cost of secessionist conflict

To empirically estimate the effect of secessionist conflict on the Philippines, one needs to compare the actual economic output of the country during the conflict period with the output it would have achieved if the conflict had not occurred. While the Philippines' income in the presence of this secessionist conflict is observable, its income in the absence of the conflict is not. For this reason, one needs to generate a counterfactual trajectory of the Philippines' income without the secessionist conflict. In order to generate such a counterfactual, I create a synthetic control group using the synthetic control method (SCM) developed by Abadie and Gardeazabal (2003) and formally motivated by Abadie, Diamond and Hainmueller (2010).

The effect of secessionist conflict, θ_t, is given by the difference between the Philippines' per capita income in the presence of secessionist conflict, y_t, and its income per capita if the conflict did not exist during the same time period, y_t^N :

$$\theta_t = y_t - y_t^N. \tag{2.1}$$

This effect can be estimated by SCM as

$$\widehat{\theta}_t = y_t - \sum_{j=1}^{J} w_j^* y_{jt}, \tag{2.2}$$

where w_j^* refers to the weight assigned to country j in the synthetic control group and y_{jt} is the income per capita of country j at time t. Each country $j = 1, ..., J$ in the synthetic control

group must be unexposed to secessionist conflict throughout the sample period for this country to qualify as a proper control unit.

The value of w_j^* must be selected such that the resulting synthetic control group associated with w_j^* closely reproduces the income levels of the Philippines prior to the secessionist conflict as well as the determinants of the Philippines' economic output. The pre-conflict levels of output determinants in the Philippines can be summarized in a vector $\mathbf{X}_1$ while the corresponding levels of output determinants in the synthetic control group can be summarized in a vector $\mathbf{X}_0$, each vector containing q variables. The vector of weights $\mathbf{W}^* = (w_1^*, ..., w_J^*)'$ can be optimally chosen as the value of $\mathbf{W}$ that minimizes:

$$\sum_{m=1}^{q} v_m \left(\mathbf{X}_{1m} - \mathbf{X}_{0m}W\right)^2 \tag{2.3}$$

where v_m is a weight assigned to variable m, reflecting the relative importance of this output determinant when matching the pre-conflict income levels of the Philippines with the income levels of the synthetic Philippines prior to the conflict period. The value of v_m can be selected such that the resulting synthetic control group approximates the trajectory of the Philippines' income per capita before the secessionist conflict began.

One prospective challenge on the accuracy of the SCM estimator $\widehat{\theta}_t$ concerns the potential confounding effects of observed and unobserved factors on income. However, if the number of pre-conflict periods is sufficiently large, then matching on pre-conflict income helps control for these potential confounding factors (Abadie *et al.* 2011). If the Philippines and the synthetic control group exhibit similar income levels over a long period of time prior to the secessionist conflict, then any discrepancy in income during the conflict period can be interpreted as being caused by the conflict itself.

2.4 Data and sample

This chapter uses country-level panel data for the Philippines and other developing countries for the period 1960-2003. The secessionist movement in Mindanao was founded in 1969 which marks the beginning of the struggle for independence from the Philippines. As the conflict period starts in 1969, this data set includes 9 years of pre-conflict data. The sample period begins in 1960 because it is the first year for which data on real per capita GDP and economic growth predictors are available for countries in the potential control group. It ends in 2003 because one country in the potential control group (Thailand) became exposed to secessionist conflict within its territory after 2003, making it ineligible as a control unit for the years thereafer. All in all, this data set contains more than three decades of conflict period, sufficient to estimate both immediate and long-run effects of secessionist conflict on economic output.

Here I give a rationale for using country-level data. While a more disaggregate level of data may seem to more precisely estimate the effect of conflict in the area where it has been concentrated, this chapter uses country-level data because region-level data on economic output and growth predictors are unavailable for the entire pre-conflict period. Moreover, the subject of the secessionist conflict is not confined within one region. Proponents of secession claim independence for a set of provinces located in different regions. Actual incidents of terrorist attacks occurred in these provinces as well as in areas for which independence is not being claimed at all. For example, members of secessionist movements have waged terrorist attacks in major cities like Metro Manila, the country's capital. This suggests a strong potential externality of the conflict on non-secessionist areas of the country. Thus, using country-level data as the unit of analysis captures spillover effects on the rest of the country.

In the following paragraphs I explain the selection of countries into the potential control group. Because the synthetic Philippines is meant to reproduce the real per capita GDP that would have been observed for the counterfactual Philippines in the absence of secessionist conflict, the potential control group must exclude countries which have been exposed to secession-related conflict during the sample period. Data on the presence of secessionist move-

ments come from the Armed Conflict Dataset (ACD) of the Peace Research Institute Oslo (PRIO).

The outcome variable of interest is annual economic output at the country level, measured in this data set as PPP-adjusted GDP per capita normalized in terms of 2005 US dollar values. I took the data on output-based real GDP from the Penn World Table (version 8.0), which can be used to compare trends in productive capacity across countries and over time.

The values of economic growth predictors for the Philippines comprise the elements in $\mathbf{X}_1$ while the corresponding values of these growth predictors for countries in the potential control group comprise the elements in $\mathbf{X}_0$. The set of economic growth predictors is chosen among the standard set of determinants in neoclassical growth models: the rate of investment flow, population density, the share of agriculture/industry/manufacturing/services in GDP, and the human capital index. The Appendix to this chapter identifies the sources of data on these variables used in this study. These variables are averaged over the whole pre-conflict period (1960-1968). Due to data limitations, countries with no available information on a growth predictor for the whole pre-treatment period had to be dropped from the sample. The synthetic control method cannot be implemented if at least one country in the sample contains no data point for a variable because it requires an average for each growth predictor throughout the pre-conflict period.

To minimize interpolation bias, I restrict the potential control group to those countries with similar pre-conflict characteristics to those of the Philippines. I chose a subset of developing countries whose pre-conflict growth predictors lie within 20 places of the Philippines' world-wide rank in each of these variables. After applying the exclusion criteria described in this section, the following countries qualified for the potential synthetic control group: Botswana, Cameroon, the Dominican Republic, Fiji, Honduras, Malaysia, Thailand and Zambia.

Using the synthetic control method, I construct a synthetic Philippines that reproduces the values of economic growth predictors in the Philippines before the secessionist conflict began. I estimate the effect of secessionist conflict on economic output as the difference in real per capita GDP between the Philippines and its synthetic counterpart during the conflict

period. I then perform a series of placebo studies to test whether my estimated effects for the Philippines are unusually large relative to the distribution of the estimates that I obtain when I apply the same procedure to countries in the control group.

2.5 Results

To evaluate the effect of secessionist conflict, this study shows how real per capita GDP would have evolved in the Philippines after 1969 in the absence of this conflict. The effects are estimated as follows.

2.5.1 Estimates of the effect of secessionist conflict

The synthetic Philippines is constructed as the convex combination of countries in the potential control group that most closely resembled the Philippines in terms of pre-conflict values of economic growth predictors. Table 2.1 presents the results of this matching, which compares the pre-conflict characteristics of the Philippines with those of the synthetic Philippines. The synthetic Philippines closely reproduces the values of per capita real GDP and most of the economic growth predictors in the Philippines prior to the secessionist conflict. The population density of the Philippines is an outlier[1] among the population density values in all the other countries in the set, which explains why matching on this variable can hardly be achieved. Nevertheless, population density was assigned a low v_m weight (0.145) among the growth predictors so that this variable is less important in the matching process than investment flow rate ($v_m = 0.282$) and industry share ($v_m = 0.201$), for which Table 2.1 indicates a good fit. The rest of the growth predictors in the Philippines were nearly reproduced by the synthetic Philippines.

[1] The average population density of the Philippines throughout the whole pre-conflict period is equal to 102 persons per square kilometer of land area. Among the 8 countries in the potential control group, the median population density among country averages prior to secessionist conflict in the Philippines is 23. The highest pre-conflict average is 80 (Dominican Republic), still way below the Philippine average.

Growth Predictor	Actual Philippines	Synthetic Philippines	Standard Error
Investment flow rate	0.043	0.0418	0.001
Population density	102.102	62.238	39.864
Agriculture (% of GDP)	27.265	28.824	1.559
Industry (% of GDP)	31.228	24.008	7.221
Manufacturing (% of GDP)	24.336	15.359	8.977
Services (% of GDP)	41.507	47.169	5.662
Human capital index	1.724	1.617	0.107

Table 2.1. Economic growth predictor means

Table 2.2 presents the weights of each country resulting from the synthetic control estimation. The weights reported in Table 2.2 indicate that economic output in the Philippines prior to the secessionist conflict is best reproduced by a weighted combination of the economic output levels in Thailand, the Dominican Republic, Fiji and Zambia. The synthetic control estimation assigns zero **W**-weights to the rest of the countries in the potential control group (note that SCM does not allow for negative weights in order to avoid extrapolation). The levels of economic output and output determinants in these countries during the years prior to the secessionist conflict are outside the convex hull of the Philippines' pre-conflict levels. Thus, these countries do not comprise the synthetic control group.

Country	Weight
Botswana	0
Cameroon	0
Dominican Republic	0.315
Fiji	0.102
Honduras	0
Malaysia	0
Thailand	0.562
Zambia	0.021

Table 2.2. Country weights in the synthetic control

The synthetic control estimates in this study reveal that the synthetic Philippines can be formed as a convex combination of Thailand, the Dominican Republic, Fiji and Zambia. The

weighted average of these countries' economic output levels generates the synthetic output of the synthetic Philippines before and during the conflict period.

Figure 2.2 displays per capita real GDP for the Philippines and its synthetic counterpart during the period 1960-2003. Per capita real GDP in the synthetic Philippines follows the trajectory of actual income per capita in the Philippines for the entire pre-conflict period. Combined with the high degree of balance on the economic growth predictors (Table 2.1), this suggests that the synthetic Philippines provides an approximation to the real GDP per capita that the Philippines would have achieved if there had been no active threat of secession.

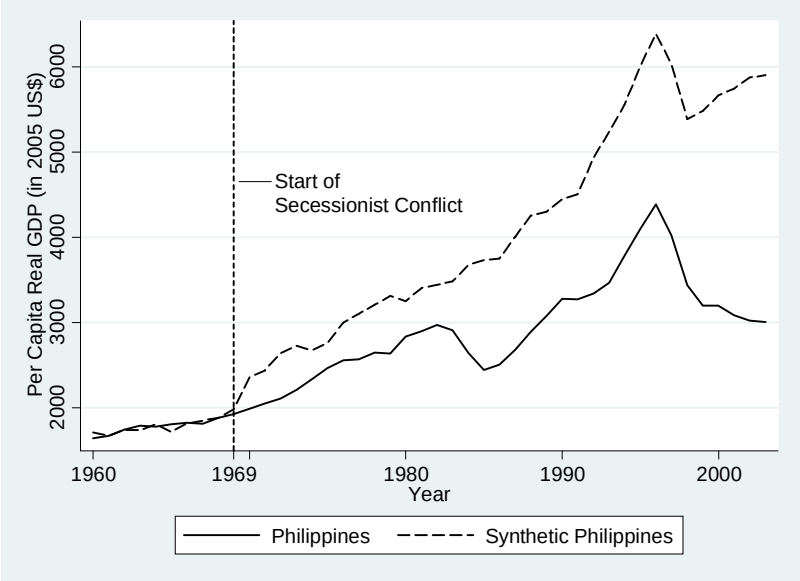


Figure 2.2. Trends in per capita real GDP: the Philippines vs. synthetic Philippines

The effect of secessionist conflict on economic output in the Philippines is estimated as the difference between the *levels* of per capita real GDP in the Philippines and its synthetic counterpart during the period of conflict. Figure 2.2 indicates that the actual GDP path of the Philippines began to diverge from its synthetic counterpart as soon as the conflict started. The actual economic output is less than the synthetic output throughout the whole period of

secessionist conflict. The gap is getting wider over time, indicating that the long-run effect on foregone economic output is growing as the conflict persists. The magnitude of this gap is reflected in the following figure.

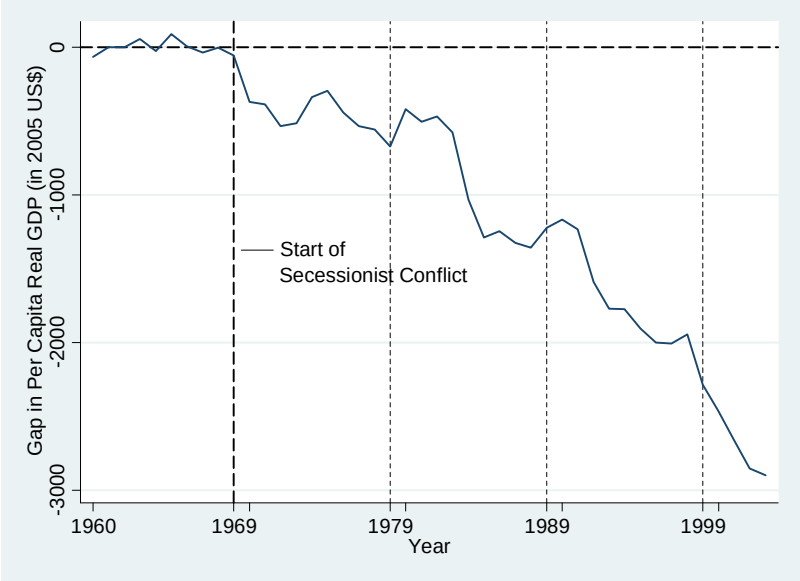


Figure 2.3. Per capita real GDP gap between the Philippines and synthetic Philippines

Figure 2.3 plots the yearly estimates of the effects of secessionist conflict, that is, the difference in per capita *levels* of real GDP between the Philippines and its synthetic version at every year since the conflict began. The *annual* economic cost is estimated at 400 US$ per capita *on average* during the first 10 years of the conflict. This is equivalent to about 18% of the Philippines' average annual real GDP per capita during the same period. In other words, the average person in the Philippines would have earned 18% more than his actual income every year during this time if the armed conflict in southern Philippines did not occur.

As the conflict persisted through another 10 years, the foregone income per capita increased to more than 800 US$ *per year,* on average. This is equivalent to 32% of the Philippines' average income per capita every year during this 10-year period. By the third decade of the conflict, when it became even more intense, the *annual* economic opportunity cost reached a 10-year

average of 1,600 US$ per capita. This value is equivalent to 46% of the average annual per capita income throughout this time period.

This economic opportunity cost captures direct effects on the affected regions and negative externalities on the rest of the country. The negative externalities arise from the overall threat to security and bad international reputation (Worldwide Governance Indicators, World Bank). They include foregone investments, among others. The pattern captured in these estimates reflects the economic impact of missed opportunities and diverted investments which would have flowed into the Philippines if the secessionist conflict had not taken place. In particular, it shows that the Philippines failed to maximize potential benefits from the influx of foreign direct investments on Southeast Asia which began in the 1980s (Silliman 1984). This was a development in which Thailand fared better (Jitsuchon 2002), and since Thailand carries 56% of the weight in the synthetic Philippines, estimates of the Philippines's counterfactual income contains information on potential economic gains that the Philippines would have realized from higher inflows of foreign direct investments, among many others.

2.5.2 Testing the validity of estimates

To evaluate the validity of these estimates, I use placebo studies to test whether the estimated gaps are a result of the secessionist conflict itself or whether these gaps are merely a "placebo effect" from introducing some form of intervention. Similar to placebo tests in medical research, I conduct this test by assigning a placebo *treatment* to each country j in the sample where no actual secessionist conflict occurred during the sample period. In each placebo run, I treat each country j as if it were subject to conflict since 1969 (when the actual conflict started in the Philippines). Then I create a corresponding synthetic control group for each country j using the synthetic control method. Every country $i \neq j$ in the sample receives a weight $w_i^* \geq 0$ in country j's synthetic control group.

After generating a synthetic control group for each country j, I estimate the counterfactual GDP level for its synthetic version as the weighted average of GDP per capita of the countries

in j's synthetic control group:

$$\sum_{\forall i \neq j} w_i^* y_{it}, \tag{2.4}$$

where y_{it} is the level of GDP per capita in country i at year t. This counterfactual GDP level can be matched against counry j's actual GDP per capita at year t, y_t^j, to generate a placebo gap for country j at year t, equal to

$$\widehat{\theta}_t^j = y_t^j - \sum_{\forall i \neq j} w_i^* y_{it}. \tag{2.5}$$

The placebo gap for each country j can be compared with the GDP gap estimated in Section 2.5.1 for the actual treatment in the Philippines. If the placebo runs display gaps of magnitude and direction similar to the estimated GDP gap for the Philippines, then the estimated effect of secessionist conflict in the Philippines is considered a mere "placebo effect." The estimated gap cannot be interpreted as an effect of the conflict itself if a similar gap manifests in cases where actual conflict (treatment) did not take place. If, on the other hand, the placebo test reveals that the gap estimated for the Philippines is exceptionally large compared to the gaps estimated in the placebo runs, then the estimated effect in the Philippines can be ascribed to the secessionist conflict because such a gap turns up only in the specific case where actual conflict (treatment) occurred.

This inferential technique developed by Abadie *et al.* (2014) serves as an alternative to traditional statistical inference. Statistical inference is not well suited when the number of units in the control group is small, when there is no randomization in the assignment of treatment, and when sample units were not selected by probabilistic sampling. This is the case when measuring the effect of a historical intervention on one country. The alternative method of inference using *placebo tests*, on the other hand, does not require a large number of comparison units nor time periods and it can be used whether data are individual or aggregate.

Figure 2.4 displays the results of these placebo studies. Each line represents the placebo gap estimated for each country in the placebo runs, more precisely, the difference in per capita

real GDP between each country and its respective synthetic version, $\widetilde{\theta}_t^j$ for every j. The superimposed thick line shows the gap previously estimated for the Philippines.

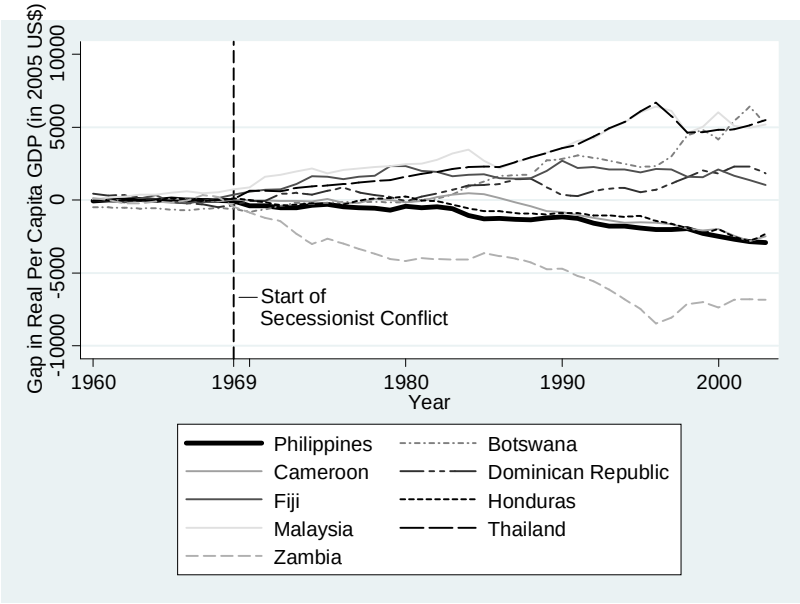


Figure 2.4. Per capita GDP gap in the Philippines and placebo gaps in sample countries

The effectiveness of each placebo run in testing the validity of synthetic control estimates is measured by the associated root mean squared prediction error (RMSPE) prior to the intervention.[2] Essentially, the pre-conflict RMSPE measures lack of fit between country j and its synthetic control group during the period before the conflict began (Abadie *et al.* 2014). A low RMSPE indicates that the resulting synthetic control group closely mimics country j, thus, it can generate a proper counterfactual. On the other hand, a high RMSPE indicates poor fit between country j and its synthetic counterpart so the resulting synthetic version of the country differs largely. To make transparent the goodness-of-fit in each placebo run in Figure 2.4, Table 2.3 presents the pre-intervention RMSPE for each synthetic country along with the

[2] Pre-conflict RMSPE= $\sqrt{\frac{1}{T_0}\sum_{t=1}^{T_0}\left(y_t^j - \sum_{\forall i \neq j} w_i^* y_{it}\right)^2}$, for all pre-conflict years $t = 1, ..., T_0$ in country j.

pre-intervention RMSPE for the synthetic Philippines. It shows that some of the placebo runs provide a good fit while some placebo runs did not generate a well-fitted synthetic version.

Synthetic Country	**Pre-intervention RMSPE**
Philippines	43.513
Botswana	572.118
Cameroon	60.408
Dominican Republic	303.467
Fiji	167.235
Honduras	64.041
Malaysia	419.167
Thailand	25.898
Zambia	191.067

Table 2.3. Pre-intervention RMSPE of synthetic countries

Placebo runs with poor fit prior to the intervention cannot serve as a proper yardstick in testing the validity of a synthetic control estimate that demonstrates proper fit. For this reason, I include in the following inference test only placebo runs with good fit, i.e., less than four times the pre-intervention RMSPE of the synthetic Philippines, and I exclude placebo runs which do not meet this threshold.

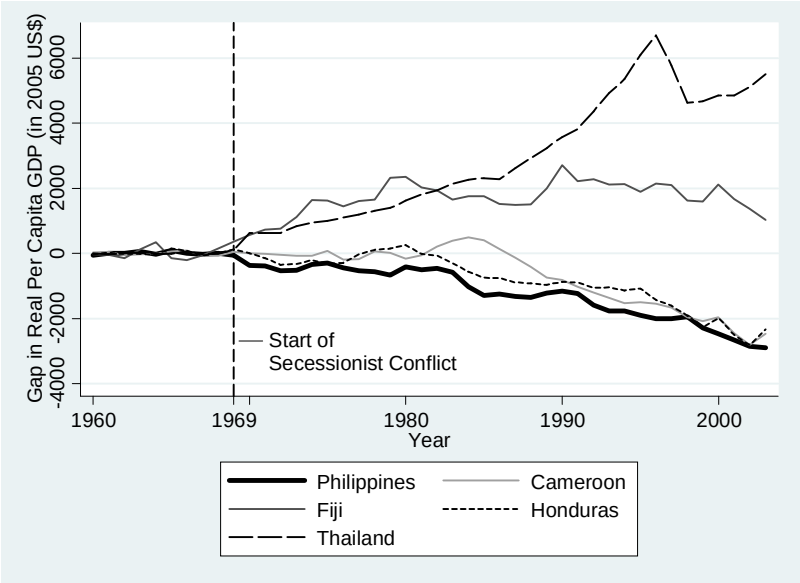


Figure 2.5. Per capita GDP gap in the Philippines and placebo gaps in countries with good fit

Figure 2.5 shows the final result of this placebo test. It evaluates the estimated GDP gap for the Philippines against the placebo gaps for countries with good fit in the placebo studies. It shows that the size of estimated gap for the Philippines is unparalleled by any of the estimated gaps in the falsification exercise. This test validates the estimated treatment effect for the Philippines as being caused by the secessionist conflict itself because the magnitude cannot be replicated in placebo treatments where actual conflict is non-existent.

As a final way to evaluate the Philippine GDP gap relative to the placebo gaps, I examine the distribution of ratios between post-conflict and pre-conflict RMSPEs. Post-conflict RMSPE measures how closely (or remotely) the synthetic country can mimic the actual country during the treatment period. A high post-conflict RMSPE indicates that the actual country deviates largely from its synthetic version during the conflict period, suggesting that the treatment has had a large effect during this period. In this final test, I normalize each country's post-conflict

RMSPE to its respective pre-conflict RMSPE, generating an RMSPE ratio equal to

$$\text{RMSPE ratio} = \frac{\text{Post-conflict RMSPE}}{\text{Pre-conflict RMSPE}}, \tag{2.6}$$

to allow for normalized comparison of GDP deviations among all countries in the sample. If the RMSPE ratio for the Philippines is larger than the RMSPE ratio for the other countries, this means that the normalized deviation of the Philippines during the treatment period cannot be replicated by placebo treatments.

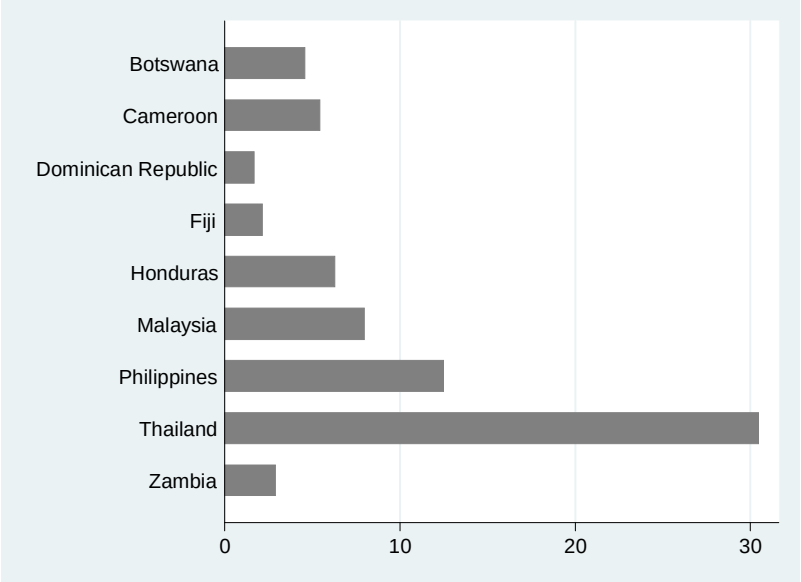


Figure 2.6. Ratio of post-conflict to pre-conflict RMSPE: the Philippines and placebo countries

Figure 2.6 displays the distribution of post-conflict to pre-conflict RMSPE ratios for the Philippines and the other countries in the sample. While the ratio for Thailand stands out in this figure, the direction of the gap estimated for Thailand is opposite to that of the Philippines (see Figure 2.5). Thus, the Thailand placebo cannot invalidate the estimated effect of intervention for the Philippines. Now comparing the post-conflict to pre-conflict RMSPE ratio of the Philippines with the rest of the sample, no other country achieves a ratio as large as the Philippines'. This indicates that the magnitude in combination with the direction of the esti-

mated treatment effect is unique to the Philippine case. Therefore, this test further strengthens the validity of synthetic control estimates in this chapter as the effect of secessionist conflict in the Philippines.

2.6 Conclusion

This study generates a synthetic Philippines as the convex combination of similar countries that are not exposed to secessionist conflict. This synthetic Philippines reveals the counterfactual levels of real per capita GDP that the Philippines would have achieved if it had not been exposed to an armed separatist conflict. The difference between the Philippines' actual income and the synthetic Philippines' counterfactual income represents the economic opportunity cost of the secessionist conflict in southern Philippines. The estimates illustrate that the annual costs are substantial and growing as the conflict persists through time. These estimates are validated by standard inference from placebo tests normally applied to synthetic control studies.

Appendix to Chapter 2

Sources of Data for Economic Growth Predictors

Investment Flow Ratio – from the Penn World Table (PWT) 8.0, measured as the rate of change in capital stock

Population Density – from the World Development Indicators of the World Bank, measured as the number of persons per square kilometer

Agriculture Share (% of GDP) – from the World Development Indicators of the World Bank, measured as the percentage value added of the agriculture sector in GDP

Industry Share (% of GDP) – from the World Development Indicators of the World Bank, measured as the percentage value added of the industry sector in GDP

Manufacturing Share (% of GDP) – from the World Development Indicators of the World Bank, measured as the percentage value added of the manufacturing sector in GDP

Services Share (% of GDP) – from the World Development Indicators of the World Bank, measured as the percentage value added of the services sector in GDP

Human Capital Index – from the Penn World Table (PWT) 8.0, based on years of schooling (Barro/Lee, 2010) and returns to years in education (Psacharopoulos, 1994)

Chapter 3

Public-Private Wage Differentials and the Quality of Government Workers in the Philippines

3.1 Introduction

Wage-setting in the public sector differs from that in the private sector. Basic theory suggests that the market wage rate must be set equal to a worker's marginal output. In the public sector, output takes some non-material form which is not fully observable nor perfectly measurable. By its nature, an employee's output in the public sector does not render itself nearly as measurable as a private sector worker's productivity. As such, his wage rate cannot be simply tied up with his own marginal output that is partly unobservable. This is how determination of wages in the public sector begins to depart from the market standard of setting wage rates. However, competitiveness in the labor market points to the private sector as a reference point when the government as an employer considers sorting among workers. To get an idea of the type of workers who enter the public workforce relative to the kind of workers in the private sector, the relative wage rates between the public and private sectors can give an indication.

This chapter measures the difference in hourly wages between public and private sector employees in the Philippines. Upon observing this differential, I proceed with examining the characteristics of public sector workers relative to their private sector counterparts.

Public-private wage differentials are of interest for both developed and developing countries where micro data on individuals and households are used to estimate the wage differentials. Controlling for factors that affect earnings and sector selection, studies find a general pattern where most developed countries pay a wage premium on public sector workers (Krueger 1988

and Poterba and Reuben 1994 for the United States; Disney and Gosling 1998 for the United Kingdom; Mueller 1998 and Mueller 2000 for Canada; Depalo *et al.* 2011 and de Castro *et al.* 2013 for a selection of European countries)[1] while developing countries and transition economies pay lower wages on public sector employees than on private sector workers (Adamchik and Bedi 2000 for Poland; Panizza et al. 2001 for the Dominican Republic, Nicaragua, Panama and Uruguay; Gorodnichenko and Sabirianova 2007 for Ukraine).

The literature on public service characterizes public sector workers as having higher pro-social motivation than private sector employees (Francois 2000; Francois and Vlassopoulos 2008; Gregg et al. 2011). This pro-social motivation takes various forms, most common among which is altruism. Buurman *et al.* (2012) and Buurman and Dur (2012) confirm that public sector workers tend to be more altruistic than private sector employees. Apart from being altruistic, government employees are also found to be relatively lazy and risk averse (Bellante and Link 1981; Buurman *et al.* 2012; Dur and Zoutenbier 2013).

This chapter finds that public sector workers in the Philippines are receiving higher hourly wages than private sector workers. It also finds that the Philippine public sector is composed of employees who are more pro-social, who work fewer hours and who are less specialized in skills compared with their private sector counterparts.

The higher wage rates in the public sector indicate that the Philippine government consists of workers who will have received lower wages if they had been employed in the private sector. The market wage rates applicable to these workers are lower than what they are receiving as employees in the government. This finding may serve as a signal on the quality of workers who are presently employed in the Philippine public sector. If the existing pool of government employees have counterparts in the private sector who are subject to lower wage rates, then the quality of these employees corresponds to the quality of their counterparts who are valued by the market at a lower rate.

The rest of the chapter is organized as follows. Section 3.2 describes the micro data set I used and the estimation approach I applied in measuring the public-private wage differentials.

[1] A review of existing literature on developed countries can be found in Gregory and Borland 1999.

Section 3.3 presents the estimated wage differentials in every occupation group. Section 3.4 proceeds with describing the quality of workers who are presently employed in the Philippine government and which worker qualities are associated with the public wage premium. Section 3.5 discusses alternative empirical strategies in measuring the public-private wage differentials and compares them with the main estimation approach used in this chapter. Section 3.6 gives a summary and conclusion. The Appendix to this chapter contains tables and figures presenting the estimation results.

3.2 Data and empirical strategy

I estimate the public-private wage differentials using data from the merged Labor Force Survey (LFS) and Family Income and Expenditure Survey (FIES), conducted by the National Statistics Office of the Philippines. The LFS contains information on individual-level employment, wages, hours worked and demographics. The FIES includes information on household-level earnings and expenditures. The LFS and FIES are based on cross sectional observations of households drawn from a nationally-representative sample. I incorporate survey weights in all my estimations to account for the complex sampling design. As the set of LFS respondents comprises an overlap with the set of FIES respondents, these two data sets can be merged by the National Statistics Office. I use the latest wave of the merged dataset which is available for the year 2009. This wave covers approximately 38,400 households and 186,800 individuals.[2]

I restrict my sample to employees whose primary occupations belong in private establishments, government, or government corporations. I exclude from the sample all self-employed individuals, employers, family workers, and workers in private households. I also exclude army personnel and government officials (they are not reasonably comparable with any private sector job). This leads to an estimation of 33,998 employees, of whom 6,211 (18%) belong to the public sector and 27,787 (82%) belong to the private sector.

I use a linear regression model to estimate the wage differentials between public and pri-

[2] More information on the LFS and FIES can be found on the official website of the National Statistics Office of the Philippines: www.census.gov.ph (in English).

vate sector workers within the same occupation group.[3] I control for demographic factors such as gender, age, marital status and family size. In addition, I include control variables for educational attainment and type of educational qualification, variables which can also proxy for unobservable factors affecting an individual's decision to select in either the private or the public sector. Sectoral preferences, for instance, may be reflected in the type of educational background and the level of schooling. I also include region fixed effects to account for variations in standards and costs of living by region of residence.

The regression equation takes a Mincerian form, specified as:

$$\ln(hwage_i) = c + \alpha_j \cdot \mathbf{occ}_j + \beta_j \cdot (pub_i \times \mathbf{occ}_j) + \delta \cdot \mathbf{dem}_i + \gamma \cdot slevel_i + \theta \cdot \mathbf{stype}_i + \sigma_r \cdot \boldsymbol{\mu}_r + \varepsilon, \quad (3.1)$$

where $hwage_i$ is employee i's hourly wage rate calculated as basic pay per day (in cash) from his primary occupation divided by his normal working hours per day, $\mathbf{occ}_j$ represents a vector of occupation categories, pub_i is an indicator which takes the value 1 if an employee belongs to the public sector and 0 if private sector, $pub_i \times \mathbf{occ}_j$ is an interaction term for public sector workers in every occupation category, $\mathbf{dem}_i$ is a vector of employee i's demographic characteristics that include age, gender, marital status and family size, $slevel_i$ is an indicator for skill level which takes the value 1 if employee i is a college graduate and 0 if non-college graduate, $\mathbf{stype}_i$ is a vector of college degree types[4] representing employee i's specialization in skills, $\boldsymbol{\mu}_r$ controls for region fixed effects,[5] and ε is an error term which is assumed to be uncorrelated with the

[3] Each employee is classified into one of the major occupation groups based on the Philippine Standard Occupation Classification (PSOC). These occupation groups include leaders (executives, managers and supervisors), professionals (teaching professionals, science professionals, health professionals, business professionals and legal professionals), associates (associate teaching professionals, associate science professionals, associate health professionals, associate business professionals and associate legal professionals), clerks, service workers (salespersons and personal service workers), agriculture workers (farmers, forestry workers, fishermen), craft workers (construction workers, metal workers, handicraft workers, food and craft workers), operators (plant operators, machine operators, drivers), unskilled workers (janitors, messengers, market vendors, among others) and a residual group of workers unclassified in the survey. The occupation group of operators is chosen as the reference category.

[4] The types of college degree include arts, social sciences, physical sciences, engineering, health sciences, agriculture, education, services and general programs. General college degree is the reference category.

[5] The regions represented in the sample are Ilocos, Cagayan, Central Luzon, Bicol, Western Visayas, Central Visayas, Eastern Visayas, Zamboanga, Northern Mindanao, SOCCSKSARGEN, Davao, National Capital Re-

covariates. *Age* and its squared form, age^2, are used as proxy for experience because age is proportional with experience and the survey does not contain a direct question on employees' work experience.

The variable of interest is the vector β_j which represents the wage differential between public sector and private sector employees within each occupation group j. Positive values of β_j indicate that public sector workers are receiving a wage premium over their private sector counterparts while negative values of β_j indicate a wage penalty on public sector workers relative to their equivalents in the private sector. I estimate the value of β_j through survey-weighted Ordinary Least Squares (OLS).

Table 3.1 (in the Appendix) summarizes the average hourly wage rates among all workers and within each occupation group. Public sector workers in general earn higher average wages than private sector workers. The difference in average wages is more pronounced among associates, service workers, craft workers and unskilled workers. Among professionals and operators, the average wage of public sector workers are almost as much as the average wage of private sector employees.

While the averages in Table 3.1 are indicative of an overall positive wage gap between public and private sector workers, a proper comparison within each occupation group requires controlling for observable factors that may explain individual earnings. Table 3.2 shows that public and private sector employees differ in observable characteristics. On average, government employees are older than private sector employees, are composed of more female workers and more married persons, belong to households of smaller family size, and are composed of more college graduates relative to private sector workers. These factors are correlated with higher wages[6] (see Table 3.3). To properly estimate the wage differential between public sector employees and their private sector counterparts, it is important to control for these observable factors so that only the wages of workers with similar background can be compared. The

gion, Cordillera Administrative Region, Autonomous Region in Muslim Mindanao, CARAGA, CALABARZON and MIMAROPA. Ilocos Region is used as the reference category.

[6] In contrast to many other countries, women in the Philippines earn higher wages than men on average. This is supported by empirical studies (for example, Sakellariou 2004) which elaborate that women's higher average wages can be explained by higher levels of human capital investment among women.

results of this estimation are presented in the next section.

3.3 Public-private wage differentials

Table 3.4 presents the wage gap by occupation group estimated through OLS using the linear regression model in eq. (3.1). Because I take the natural logarithmic values of hourly wage as dependent variable, the coefficient estimates of β_j represent the estimated difference in hourly wages as a percentage of private sector workers' hourly wage.

3.3.1 Without region fixed effects

Column (1) shows the estimated wage gap controlling for demographic factors, skill level, skill types and occupation fixed effects, without including region fixed effects. This estimation procedure compares employees residing across the whole country. The estimation results show significant differences in wage rates between the public and the private sectors. Public sector workers taking on leadership positions (executives, managers and supervisors) receive hourly wages that are 20.9 percent more than the hourly wages of their counterparts in the private sector (p-value: 0). Likewise, professionals in the public sector receive a wage premium of 14.8% (p-value: 0).

Service workers are found to receive the highest wage premium in the public sector, equivalent to 22.4% of private service workers' hourly wage. This estimate is statistically significant up to the 1% level (p-value: 0). Service workers refer to those who provide personal and protective services (according to the Philippine Standard Occupation Classification). Their jobs include child care, preparation and serving of food and beverages, fire-fighting, police work and sales. The large premium in the public sector for service workers may be due to strong competition within the private sector. The service industry comprises 47.5% of the Philippine economy[7] and thus a major fraction of the labor force. Strong competition in the private labor market may be driving down the private sector wage rate which translates into a higher premium in the public sector where wages are standardized by law.

[7] Source: National Statistical Coordination Board

Unskilled public sector employees, whose jobs include office helpers and cleaners, messengers, doorkeepers and garbage collectors, receive 15.9% more than their counterparts in the private sector (p-value: 0). Agriculture workers in the public sector are also found to receive a wage premium over private agriculture workers (approximately 18.2%) even though the wage premium is less precisely estimated for this group (p-value: 0.121). The wage gaps estimated for associates, craft workers and unclassified workers (which are all negative) are economically and statistically insignificant.

Finally, estimates that do not control for region fixed effects show that clerks in government offices are receiving lower wages than private sector clerks residing across the whole country. This wage penalty of 14.3% is both economically significant and statistically significant at the 1% level (p-value: 0). This can be interpreted to mean that a government clerk in one region is earning less than a private clerk who could be living in another region. We need to verify whether this wage differential is due to geographical location or not. In other words, we need to see whether the wage penalty remains if we compare public and private sector clerks residing in the *same* region. If it disappears, then this wage gap can be attributed merely to regional variations in living standards and not on the sector of employment.

3.3.2 With region fixed effects

In column (2), I control for region fixed effects in order to compare employees within the same region. Controlling for region fixed effects filters away institutional factors that may vary across regions. Such regional variation is supported by statistical accounts in Table 3.5 which shows how per capita levels of consumption vary by region. For instance, consumption in the National Capital Region is equivalent to 186% of the national average while in a region like Northern Mindanao, consumption is as low as 75% and in the poorest region (ARMM), consumption is only 46% of the national average.

Estimates in column (2) of Table 3.4 indicate that the public-private wage differentials are positive, if not statistically different from zero, across all occupation groups. It signifies that public sector employees compared to their private sector counterparts within the same region

are actually receiving a higher wage rate. The public wage premium is highest among leaders, 33.6% (p-value: 0). This is followed by the wage premium among public professionals, 27.5% (p-value: 0), and public sector service workers, 25.4% (p-value: 0). Even after controlling for region fixed effects, the public wage premium for unskilled workers remain positive at 11.3% (p-value: 0).

Contrary to the estimate in column (1), public sector associates are found to receive higher wage rates (5.8%; p-value: 0.113) compared to private sector associates in the same region. The reversal of direction in column (2) indicates that the (insignificant) wage penalty earlier estimated for public sector associates may be due to regional heterogeneity. Indeed, an inspection of geographic distribution in Table 3.6 reveals that private sector associates are more concentrated in regions characterized with higher standards of living (National Capital Region and CALABARZON, where consumption per capita are above the national average), while public sector associates are evenly dispersed across all regions. This explains the private wage advantage displayed in column (1) that was overturned after controlling for region fixed effects in column (2).

The private sector wage advantage for clerks and craft workers disappear once region fixed effects are controlled for. This indicates that public and private sector clerks (craft workers) residing in the same region are receiving basically equivalent hourly wage rates. This finding reflects a similar situation as associates in terms of geographic distribution. Table 3.6 reveals that a majority of private sector clerks and craft workers are located in regions where per capita consumption levels are above the national average. Thus, the private sector wage advantage estimated for these occupation groups in column (1) appears as a consequence of comparing public sector workers with private sector employees who are mostly concentrated in regions with higher standards of living. When comparing employees located in the same region, it occurs that clerks and craft workers in the public and private sectors are not subject to a significant wage differential.

The wage premium for public agriculture workers remain positive but statistically insignificant. It cannot be said that farmers, fishermen and forestry workers employed by the govern-

ment are earning more than the private agriculture workers in the same region.

3.3.3 Richer regions vs. poorer regions

In Table 3.7, I present wage differentials within each of two subsets of regions classified according to economic activity. Richer regions refer to those with consumption per capita on or above the median while poorer regions pertain to those below the median consumption level. It shows that in most cases, the public wage premium is higher within the subset of poorer regions. For instance, public sector professionals are receiving a wage premium of 44.4% in poorer regions (p-value: 0) and only 9.1% in richer regions (p-value: 0). Service workers receive a public wage premium of 53.0% in poorer regions (p-value: 0) compared to 14.9% in richer regions (p-value: 0). These large premia may be explained by weaker competition between the public and private sectors in poorer regions where the economy is less vibrant and thus private sector wages are lower than in richer regions. Richer regions, on the other hand, have a competitive private sector where market wage rates can catch up with public sector wage rates.

3.3.4 By age bracket

In this sub-section, I show how the public-private wage differentials vary with years of experience. Public sector workers may have longer years of work experience relative to private sector workers, which make them more eligible for higher pay. Indeed, Table 3.2 supports that on average, government workers are older than private sector employees. Since experience is directly proportional with age, government employees can be said to have more years of work experience than private sector employees on average. The OLS estimates presented in Tables 3.4 and 3.7 account for this potential endogeneity by including age and age^2 as proxy for experience among the demographic variables. These explanatory variables turn up with the expected coefficients: positive for age, 2.3%, and negative for age^2, -0.023%, both statistically significant at the 1% level. These estimates confirm the standard inverted U-shaped relationship between age and wages – increasing during early years and decreasing later on.

In order to observe the pattern between experience and the public wage premium, I estimate the public-private wage gap at different age brackets. I sub-divide the sample into 5-year age groups and apply OLS on eq. (3.1) for eage age bracket. The idea is to group together employees who have more or less similar years of work experience and to find the pattern in observed wage differentials between less experienced workers and more experienced workers. These OLS estimates used the full set of demographic variables except *age* and age^2.

Figure 3.1 (in the Appendix) illustrates the pattern between experience and the public wage premium on four occupation groups where the estimated differentials are statistically significant: leaders, professionals, service workers and unskilled workers. It depicts an inverted U-shaped pattern similar to the relationship earlier found between age and hourly wage rates. It shows that the public wage premium varies with age, and thus experience, and remains positive throughout most of an employee's career. Among employees of similar experience levels, the public sector employees appear to be receiving a premium over their private sector cohorts.

3.3.5 By gender

On average, the proportion of females to males in the public sector is higher than the proportion in the private sector (Table 3.2). I proceed with examining whether women are receiving a higher or lower public wage premium compared to men. I sub-divide the sample into two groups, male and female, and apply OLS to estimate eq. (3.1) in each group. This allows me to estimate the public wage premium within the sub-sample of women and compare it with the public wage premium within the sub-sample of men. These regressions used the full set of demographic variables except gender.

Table 3.8 shows that the difference in the levels of public wage premia between men and women vary depending on the occupation group. Among leaders and among professionals, women are receiving a higher public wage premium than the public wage premium received by men. Female leaders in the public sector are receiving 46.1% more (p-value: 0) than female leaders in the private sector. Male leaders, on the other hand, are receiving a public

wage premium of 20.6% (p-value: 0.001) over their counterparts in the private sector. Female professionals employed in the government earn 34.6% more (p-value: 0) than their counterpart female professionals in private establishments. On the other hand, male professionals in the government receive a wage premium of 13.2% (p-value: 0.001) over male professionals employed in the private sector.

For service workers, the story is different. Female service workers are receiving a lower public wage premium (15.7%; p-value: 0.033) than male service workers (25.4%; p-value: 0). Among unskilled workers, the public wage premium among men remains positive and significant (13.4%; p-value: 0) while the public wage premium among women disappears.

3.4 The quality of government workers

In this section, I describe the type of workers in the public sector relative to their counterparts in the private sector. Then I examine the qualities of government employees associated with the public wage premium measured in the previous section.

3.4.1 Skill level and skill types

One may wonder whether the wage premium observed in the public sector reflects positive skill selection among government workers. In other words, could it be that public sector workers are better-skilled than their private sector counterparts? It can be seen in Table 3.2 that a higher percentage of government employees are college graduates (55%) compared to only 15% among private sector employees. I proceed with testing whether public sector workers are equipped with superior skill levels and skill types within each occupation group, controlling for observable factors such as gender, age, civil status, family size and region fixed effects.

For every occupation group j, I estimate the following probit model on employee i's probability of being in the public sector:

$$\Pr(pub_{i\in j}) = c + \delta_j \cdot \mathbf{dem}_{i\in j} + \gamma_j \cdot slevel_{i\in j} + \theta_j \cdot \mathbf{stype}_{i\in j} + \sigma_j \cdot \boldsymbol{\mu}_r + \varepsilon_j, \qquad (3.2)$$

where $pub_{i\in j}$ is an indicator which takes the value 1 if employee i in occupation group j belongs to the public sector and 0 if private sector, $\mathbf{dem}_{i\in j}$ represents the demographic characteristics of employee i in occupation group j, $slevel_{i\in j}$ refers to the skill level attained by employee i in occupation group j, $\mathbf{stype}_{i\in j}$ pertains to the skill type acquired by employee i in occupation group j, $\boldsymbol{\mu}_r$ stands for region fixed effects and ε_j is the error term. Skill level is measured by a dichotomy between college graduates and non-college graduates (non-college degree holders are taken as reference group in skill level). Skill types are distinguished according to the category of college degrees (among college graduates), with general college degree as reference category. General college degrees comprise Bachelor of Arts and Bachelor of Science programs with no field of specialization (based on the Philippine Standard Classification of Education). The specialized skill types belong to one of the following college degrees: education, arts, social sciences, physical sciences, engineering, agriculture, health sciences and services. The probit estimates on each of these college degrees, represented by $\widehat{\theta}_j$, represent the relative probability of working in the public sector for college graduates with a specialized degree compared to college graduates with a non-specialized degree.

Table 3.9 presents the marginal effects resulting from this probit estimation. It shows that among employees in the leaders' occupation group, college graduates are more likely to be in the public sector. Service workers who have obtained a college degree are also significantly more likely than non-college graduates to be employed in the government. Thus, the public wage premia among leaders (33.6% based on Table 3.4) and service workers (25.4%) can be explained in part by their higher skill levels in terms of college educational attainment.

On the other hand, college graduates who are working as professionals are not significantly more likely to choose employment in the public sector. The wage premium that public sector professionals are receiving (27.5%) cannot be associated with higher skill levels among government employees in this occupation category.

Among employees classified as unskilled workers (helpers, cleaners, messengers, and others) the public wage premium (11.3%) is associated with higher skill level among government-employed workers. College graduates in this occupation category are significantly more likely

to be in the public sector compared with non-college graduates. Public sector employees in this occupation category comprise 5% of all workers who report unskilled jobs as their primary occupation. Among public sector workers in this group, 7% are college graduates compared to 1% among the private sector workers. Unskilled workers in the public sector usually take on jobs as helpers and cleaners in offices, sweepers, construction and maintenance laborers, messengers, package and luggage porters while those in the private sector include farmhands and other manual farm laborers, hand packers and other manufacturing manual laborers, construction and maintenance laborers, helpers and cleaners in offices and hotels, messengers, package and luggage porters.

Analysis can also be made on whether the public wage premium reflects specialization in the type of skills that public sector workers possess. Table 3.9 shows that employees with more specialized college degrees are in many cases less likely to be working in the public sector. Among leaders, those with a college degree in education, social science, physical science, engineering, agriculture and services are significantly less likely to be in the public sector compared to those with non-specialized college degrees (Bachelor of Arts and Bachelor of Science in general programs).

Only among professionals is one specialized degree more inclined to be in the public sector. Professionals holding a college degree in education are signficantly more likely to be government employees. This observation is in line with the fact that this occupation group consists of teaching professionals (60.47% in the sample) and public sector professionals in general receive a significantly positive wage premium over private sector professionals (27.5%).

The rest of the occupation groups exhibit either a negative probability or a non-significant difference in probability of public sector employment among workers holding a specialized college degree. While this chapter does not seek to explain the reasons behind these differences in probability, it shows that the differential probabilities (when they are significant) are not associated with the public wage premium except for teaching professionals. Specifically, the public wage premium among leaders, service workers and unskilled workers do not reflect more specialization in skill types in the public sector.

3.4.2 Effort level

Among the ranks of objective factors associated with the public-private wage differential, another candidate points to the level of effort that public sector employees exert on the same type of job. I estimate the public-private differential in effort levels measured by the employees' response to a survey question on total number of hours worked during the past week.[8] Total number of hours worked is an observable measure of effort that is also used in standard empirical studies. Although it does not perfectly capture effort in a strict sense, other dimensions of effort are not as directly measurable as hours worked. Thus, I take this variable as proxy for effort level, which is reported in the survey data.

To estimate the public-private differential in hours worked, I use the following regression equation:

$$hours_i = c + \phi_j \cdot \mathbf{occ}_j + \lambda_j \cdot (pub_i \times \mathbf{occ}_j) + \delta \cdot \mathbf{dem}_i + \gamma \cdot slevel_i + \theta \cdot \mathbf{stype}_i + \sigma_r \cdot \boldsymbol{\mu}_r + \varepsilon, \quad (3.3)$$

where $hours_i$ refer to employee i's total number of hours worked in one week, and the covariates $\mathbf{occ}_j$, pub_i, $\mathbf{dem}_i$, $slevel_i$, $\mathbf{stype}_i$ and $\boldsymbol{\mu}_r$ are as defined in Section 3.2 for eq. (3.1). Controlling for occupation fixed effects through the vector $\mathbf{occ}_j$ effectively accounts for occupation-specific demands on effort level. The variable of interest, λ_j, captures the differential in total hours worked between public and private sector workers within the same occupation group.

Table 3.10 reports the hours differential estimated through OLS. In contrast to the positive wage premium observed for public sector workers, it shows that government employees report less hours of work than their counterparts in the private sector. Public sector executives, managers and supervisors work 2.34 hours less in a week compared with executives, managers and supervisors in the private sector (p-value: 0.001). Significant differences are also observed among public sector associates, who work 4.65 hours less than their private sector counterparts

[8] This is not the same variable I used in calculating the hourly wage rate. For the hourly wage rate, I used as denominator the number of normal working hours *per day*.

(p-value: 0), public sector clerks (4.53 hours less; p-value: 0), public sector service workers (10.46 hours less; p-value: 0) and public sector craft workers (1.90 hours less; p-value: 0.014). Professionals in the civil service also tend to report fewer hours of work than counterpart professionals in the private sector (0.70 hours; p-value: 0.072) although this difference is smaller than the hours differential in other occupation groups.

Public sector workers are generally found to work fewer hours than their counterparts in the private sector, and thus exert less effort, while they receive higher wage rates. Figure 3.2 illustrates the discrepancy in wages and effort levels between public and private sector employees in each occupation category. It depicts the irony that government employees are earning higher wages than their equivalents in the private sector yet they are exerting less effort. This is consistent with other studies, both theoretical and empirical, which find that in general government employees exert less effort than private sector workers (for example, Buurman *et al.* 2012 and Dur and Zoutenbier 2013).

3.4.3 Pro-social motivation

The analysis so far cannot in large part associate the observed public wage premium with public employees' effort levels nor specialization in skills. Examining the wage premium then leads one to check out other dimensions that distinguish public sector workers from private sector employees.

There is a growing consensus in the literature that individuals with more pro-social orientation tend to select into the public sector (Francois 2000; Francois and Vlassopoulos 2008; Gregg *et al.* 2011; Buurman *et al.* 2012; Buurman and Dur 2012). In this sub-section, I show that public sector employees in the Philippines exhibit higher levels of pro-social behaviour relative to their private sector counterparts. Moreover, this pro-social premium corresponds with the public wage premium described in the previous section. I measure pro-social behaviour as a household's total gifts and contributions to others, a value reported in the survey data as the sum of gifts and contributions outside the family, contributions to church, contributions to other institutions, and other gifts and contributions. Giving behaviour represents pro-social

motivation in the sense that it consists of transfers for the benefit of its recipients while involving tangible costs to the benefactor. While there are arguably many forms of pro-social action and pro-social motivation itself, in its pure form, is not perfectly measurable, giving behaviour is both directly observable and directly correlated with pro-social motivation. For this reason, I use the value of total gifts and contributions as a proxy measure of pro-social motivation.

I estimate the public-private differentials in giving behaviour through the following linear regression:

$$\ln(gifts_m) = c + \phi_j \cdot \mathbf{occ}_j + \tau_j \cdot (pub_i \times \mathbf{occ}_j) + \delta \cdot \mathbf{dem}_i + \gamma \cdot slevel_i + \theta \cdot \mathbf{stype}_i + \sigma_r \cdot \boldsymbol{\mu}_r + \varphi \cdot hwage_i + \varepsilon, \quad (3.4)$$

where $gifts_m$ refer to the total value of gifts given by household m where employee i belongs, $hwage_i$ is the hourly wage rate received by employee i, and the rest of the covariates are as defined in Section 3.2 for eq. (3.1). Controlling for hourly wage rates allows for comparison of giving behaviour among employees of the same income levels and eliminates the pure income effect on giving.

The variable of interest is τ_j which stands for the difference in the value of gifts given by households where public sector employees belong and the value of gifts given by households where private sector employees belong. Table 3.11 presents the results of this estimation procedure. It shows that public sector employees belong to households who give substantially more than the households where private sector employees belong, holding all other observable factors constant. In every occupation group (except agriculture workers, where the public sector consists only 1%), the public sector premium in gift-giving is economically and statistically significant. For instance, the public-private differential in gift-giving among professionals is equivalent to 25.6% of total gifts given by households where private sector professionals belong (p-value: 0). Likewise, service workers in the public sector are giving more with the difference equivalent to 25% of the total gifts given by their counterparts in the private sector (p-value: 0.001).

Figure 3.3 illustrates the association between the public wage premium and the public premium in pro-social behaviour. In occupation groups with significant levels of public wage premium (leaders, professionals, service workers and unskilled workers), the corresponding premium in pro-social behaviour is also substantial. For each of these occupation groups, the pro-social premium among government employees is of almost equal size as, if not bigger than, its respective public wage premium.

The wage advantage that public sector workers receive in comparison to their private sector colleagues are found to reflect the higher level of pro-social behaviour that government workers exhibit relative to private sector employees. Among the factors examined in this chapter, pro-social behaviour is by far the one most consistently associated with the public wage premium. It is worth examining whether this differential in giving behaviour may be motivated by less altruistic reasons like reciprocity. It can be checked whether public sector employees are giving more in expectation of receving more in return. This can be analyzed from column (2) in Table 3.11. It shows the public-private differential in gifts received by household m where employee i belongs, estimated using the same set of regressors in eq. (3.4). I use $\ln(gifts\ received)$ as outcome variable so the estimates of τ_j in this case express the public-private differential as a proportion of gifts *received* by households where private sector employees belong.

Column (2) shows that in most occupation groups, the value of gifts received by households where public sector employees belong is not significantly different from the value of gifts received by households where their private sector counterparts belong. Thus, it does not give evidence that the public premium in gift giving is met with a corresponding premium on gifts received by public sector workers. In cases where the difference is weakly significant (at the 10% level), public sector employees appear to be receiving less gifts. Only the group of unskilled workers stand out. Unskilled workers in the public sector are found to be receiving more gifts than their counterparts in the private sector (13.7%; p-value: 0.044) and this difference is statistically significant. These public sector unskilled workers are also giving more than those in the private sector (40.6%; p-value: 0) as column (1) indicates. For this group, the public-private differential in *net gifts given* may be more salient. Net gifts given by household

m where employee i belongs is measured as the difference between total gifts and contributions to others and the value of gifts it received. Column (3) shows that the net gifts given by households where public sector unskilled workers belong is higher than the net gifts given by the households of their private sector counterparts. The difference is estimated as 21.8% of the net gifts given by households of private sector unskilled workers (p-value: 0.085). This public-private differential is closer to the size of the public wage premium (11.3%; p-value: 0) earlier found for unskilled workers than is the differential in total gifts given (40.6%; p-value:0). Thus, the public-private differential in net gifts given by unskilled workers is a better reflection of the public wage premium in this occupation group. Nevertheless, the positive association between pro-social behaviour and public wage premium remains across all occupation groups where the public-private wage differentials are significant.

3.4.4 Risk aversion

Since the government offers more job security and predictability than private sector employers, it may be inclined to attract workers who are more risk averse than private sector workers. Existing studies in other countries confirm this hypothesis (Bellante and Link 1981; Buurman *et al.* 2012; Dur and Zoutenbier 2014). In this sub-section I test whether public and private sector workers in the Philippines exhibit different levels of risk aversion and if so, whether this difference corresponds to their wage differentials.

I compare risk aversion levels between public and private employees using proxy indicators of risk aversion available in the data set. The only proxy variables contained in the survey which can capture some aspects of risk aversion are tobacco consumption and spending on alcoholic beverages, both at the household level. Because these two commodities pose health risks, lower consumption levels may indicate higher degrees of risk aversion. I estimate differential rates of risk aversion between public and private sector workers based on consumption of commodity

$k \in \{tobacco, alcohol\}$ with the following regression equation:

$$\ln(con_m^k) = c^k + \phi_j^k \cdot \mathbf{occ}_j + \rho_j^k \cdot (pub_i \times \mathbf{occ}_j) + \delta^k \cdot \mathbf{dem}_i + \gamma^k \cdot slevel_i + \theta^k \cdot \mathbf{stype}_i + \sigma_r^k \cdot \boldsymbol{\mu}_r + \varphi^k \cdot hwage_i + \varepsilon, \quad (3.5)$$

where con_m^k is total expenditure on risk commodity k in household m where employee i belongs, $hwage_i$ is the hourly wage rate that employee i earns, and the rest of the covariates are as described before. By including the hourly wage rate, this equation controls for income effects on consumption and effectively compares public and private sector employees at similar income levels.

The variable of interest is ρ_j^k which represents the difference in risk-taking behaviour between public and private sector employees in occupation group j. Table 3.12 presents the public-private differentials in risk-taking in terms of tobacco consumption (column 1) and alcoholic beverage consumption (column 2). It shows that there is no statistically significant difference in tobacco consumption between public and private workers across all occupation groups. If risk aversion is measured in terms of consumption of a health-risk commodity such as tobacco, then there is no observed difference in risk aversion levels between the two sectors. On the other hand, if risk aversion is measured in terms of spending on alcoholic beverages, then some differentials turn up in some occupation groups. These are the same occupation groups for which the highest levels of public-private wage gaps were observed. Leaders and professionals employed in the government report lower consumption levels of alcoholic beverages compared with their private sector counterparts who earn the same wage rates. This can indicate that government executives, managers, supervisors and professionals may be more risk averse than their equivalents in the private sector. In a way, part of the public wage premium these employees are receiving may be interpreted as compensation for their risk aversion.

On the contrary, government workers in the services sector as well as publicly-employed unskilled workers, who likewise enjoy substantial wage premia, tend to consume more alcoholic beverages than their private sector counterparts. Public sector employees in these occupation

categories may be construed as being less risk averse. Thus, the wage premium they are receiving cannot be expressed as compensation for risk aversion.

Figure 3.4 summarizes the comparison of public-private wage gaps and risk aversion differentials in these four occupation groups. The public wage premium for leaders and professionals corresponds with higher degrees of risk aversion. For service workers and unskilled workers, the public wage premium corresponds with lower levels of risk aversion relative to their counterparts in the private sector.

3.5 Alternative estimation strategies

In this section, I describe alternative approaches in estimating the public-private wage differentials and show that the estimates in Section 3.3 are robust to an alternative matching strategy. These approaches sub-divide the sample into occupation groups and estimate the wage gap within each sub-sample. One strategy is standard in the empirical literature and applies OLS in estimating the public-private wage differentials. Another approach is to match individuals based on propensity scores and measure the wage difference between public employees and their resulting matches in the private sector. These alternative approaches have advantages and disadvantages compared with the main empirical strategy I have employed in this chapter. By splitting the sample into occupation groups, each estimation makes use of fewer observations and thus carries lower statistical power. On the other hand, propensity score matching (PSM) has the intuitive appeal of identifying reasonable matches with which to compare public sector employees. In this section, I show that the OLS estimates within sub-samples suffer from poorer fit compared with the full sample estimates as a consequence of the smaller size. As a result, its estimates of the wage differentials are lower in magnitude although they display the same direction and levels of significance. On the other hand, estimates based on PSM are close to the full sample estimates described earlier, in terms of magnitude, direction and statistical significance. This matching approach provides further support to the estimates of public-private wage differentials measured through this chapter's main empirical strategy described in Section 3.2.

3.5.1 OLS within each occupation group

With this approach, the public-private wage differential in each occupation group j is estimated by OLS from the following equation:

$$\ln(hwage_{i\in j}) = c + \widetilde{\beta_j} \cdot pub_{i\in j} + \widetilde{\delta_j} \cdot \mathbf{dem}_{i\in j} + \widetilde{\gamma_j} \cdot slevel_{i\in j} + \widetilde{\theta} \cdot \mathbf{stype}_{i\in j} + \widetilde{\sigma_r} \cdot \boldsymbol{\mu}_r + \varepsilon, \quad (3.6)$$

where $pub_{i\in j}$ is an indicator which takes the value 1 if employee i in occupation j belongs to the public sector and 0 if private sector, and the rest of the covariates for each individual i belonging to occupation group j are as explained previously for eq. (3.2). The variable of interest is $\widetilde{\beta_j}$ which measures the difference in wages between public and private sector employees in the sub-sample of each occupation group. Table 3.13 presents the results of this estimation approach vis-a-vis the full sample estimates described earlier (from Table 3.4 column 2). It shows positive and significant public wage premia in the same occupation groups where the full sample regressions revealed significant wage differentials. However, the sizes of these differentials are mostly smaller in the sub-sample regressions. For leaders, the public wage premium is estimated at 17.8% (p-value: 0.001), lower than the 33.6% public wage premium (p-value: 0) estimated in the full sample. For professionals, it is 15.6% (p-value: 0) compared with the 27.5% (p-value: 0) in the full sample. For service workers, the public wage gap is estimated at 21.3% (p-value: 0) in the sub-sample regression, lower than the 25.4% (p-value: 0) found in the full sample. For unskilled workers, the estimated public wage premium within the sub-sample is 14.9% (p-value: 0), slightly higher than the 11.3% wage premium (p-value: 0) estimated from the full sample.

Each sub-sample regression in Table 3.13 displays lower levels of adjusted R-squared compared with the full sample regression so it cannot be considered a better fit. The resulting estimates of the public-private wage differentials cannot be considered more precise than the full sample estimates described in Section 3.3. At best, they confirm that public sector employees are receiving a wage premium over their private sector counterparts. For more precise

estimates of the size of this wage premium, I turn to another alternative approach that involves matching employees in the public and private sectors within each occupation group.

3.5.2 PSM within each occupation group

With propensity score matching, employees in the public sector are matched with their counterparts in the private sector based on the conditional probability of working in the public sector given a set of observed covariates. This conditional probability is summarized in propensity scores. Private sector employees within the neighborhood of each public sector employee's propensity score are considered good matches with which to compare wages. The wage differential due to sector of employment is measured as the difference in observed wages between public sector employees and their resulting matches from the private sector in the same occupation group.

To generate propensity scores, I use the same set of covariates in eq. (3.6) :

$$X \in \left\{ \mathbf{dem}_{i \in j},\ slevel_{i \in j},\ \mathbf{stype}_{i \in j},\ \boldsymbol{\mu}_r \right\} \tag{3.7}$$

for each employee i in occupation j. Based on these propensity scores, public sector employees are matched with their private sector equivalents (I use the matching algorithm which takes the nearest 5 neighbors, with replacement).

Table 3.14 presents the results of propensity score matching within each occupation group. In occupation groups where matching was properly achieved, the wage differentials, represented by the average treatment effects on the treated (ATT), resemble the OLS estimates of wage differentials from the full sample. (Estimates of ATT represent the difference between public sector employees' actual wage rates and their counterfactual wage rates if they had been employed in the private sector instead). For instance, the public wage premium on professionals is estimated as 28.5% by PSM, statistically significant at the 1% level, just like the 27.5% wage premium estimated by OLS from the full sample. For service workers, PSM found a public wage premium of 30.3% (statistically significant at the 1% level) compared with 25.4% premium (also

statistically significant at the 1% level) estimated from the full sample. For unskilled workers the public wage premium is estimated by PSM at 15.4% whereas it is measured at 11.3% by OLS from the full sample (in both cases, statistically significant at the 1% level).

While the concept of propensity score matching identifies an objective procedure in matching public and private sector employees, one drawback in estimating the wage differential by PSM is that proper matching cannot be achieved in some cases. In particular, the group of leaders in the public sector cannot be properly matched with their private sector counterparts based on propensity scores. The standardized bias in covariate matching within this occupation group is 7.44%, higher than the maximum acceptable standardized bias (5%) in most studies that use PSM (Caliendo and Kopeinig, 2008). In addition, the Pseudo R-squared is not low (0.373) which is a further indication that the match quality is not satisfactory. For this reason, estimates of ATT and thus the wage differential between public and private sector leaders cannot be reported as valid. The same is true for the case of agriculture workers and unclassified workers, for which I do not report estimates of the wage differentials.

Nonetheless, matching by propensity scores validates the estimates of public-private wage differentials generated through the main empirical strategy in this chapter. It confirms that public sector employees in the Philippines are receiving a wage premium over their counterparts in the private sector. Moreover, the size of this wage premium estimated by OLS from the full sample is virtually precise if we take results from the matching procedure as a point of comparison.

3.6 Summary and conclusion

This chapter finds that public sector workers in the Philippines are receiving higher hourly wage rates compared with their counterparts in the private sector. This situation is different from other developing countries where government employees appear to be receiving lower wage rates than private sector employees.

This study also demonstrates that the public wage premium in the Philippines is being paid on employees whose skills are less specialized, who exert less effort but altogether are

more pro-social than their private sector counterparts. While this chapter does not attempt to explain the reasons behind these wage differentials nor the process involved in setting wages, it describes the relationship between the public wage premium and the quality of public workforce in the Philippines.

This study finds that employees in occupation groups subject to a higher public wage premium are characterized with more pro-social behaviour. Among the traits examined in this chapter, pro-social behaviour is the quality that is most consistent and clearly associated with the public wage premium. This observation establishes that higher wages in the public sector corresponds with more pro-social motivation among government workers.

Differentials in effort level also reveal systematic results. While government employees are found to receive higher wages relative to their private sector counterparts, they are also found to be working fewer hours.

This chapter finds that college graduates are more likely to work for the public sector than are non-college graduates. However, among college graduates, those who obtained more specialized degrees tend to be employed in private establishments rather than in government agencies. As a result, government employees are characterized with skills that are less specialized than those of private sector employees. Thus, the public wage premium cannot be interpreted as a premium for skill specialization in the government's workforce.

The findings of this chapter signify that the existing set of public sector workers consists of employees who would have been receiving lower wages if they had been employed in the private sector. In other words, their private market value is lower than what they are presently earning because their counterparts employed in the private sector are receiving lower wages. If the private sector wage rate reflects the quality of its own employees, then the lower wages that private employers pay the counterparts of existing public sector workers serve as an indication of the actual quality of these government employees. Their counterparts are those who are receiving lower wage rates and are therefore of lower quality by market standards.

Appendix to Chapter 3

Table 3.1. Average hourly wages, 2009 (in current Philippine pesos)

	Public	Private	Difference (Public-Private)
	(1)	(2)	(3)
All occupations	63.632	35.889	27.744 ***
	(43.564)	(59.305)	(0.882)
	5,034	24,099	
Leaders	112.553	103.546	9.007
	(60.978)	(187.498)	(13.082)
	211	840	
Professionals	81.345	80.845	0.500
	(34.753)	(60.077)	(1.761)
	1,781	1,123	
Associates	63.050	57.079	5.971 **
	(38.506)	(47.469)	(2.665)
	430	796	
Clerks	47.662	49.537	-1.876
	(27.173)	(67.920)	(2.453)
	814	2,103	
Service workers	49.199	28.898	20.301 ***
	(32.535)	(85.561)	(3.405)
	648	3,557	
Agriculture workers	32.042	23.220	8.822
	(15.821)	(13.766)	(6.962)
	4	216	
Craft workers	39.137	35.007	4.13 **
	(25.641)	(18.062)	(1.835)
	102	3,862	
Operators	37.397	37.844	-0.446
	(17.460)	(29.996)	(2.494)
	149	1,719	
Unskilled workers	29.943	23.174	6.77 ***
	(14.291)	(14.751)	(0.643)
	555	9,823	
Unclassified workers	38.413	31.347	7.066
	(33.011)	(23.124)	(8.738)
	10	46	

Notes:

1. Standard errors are in parentheses.
2. No. of observations are indicated below the standard errors.
3. Statistical significance is indicated by *** (α=1%), ** (α=5%), * (α=10%).

Source: Merged LFS and FIES 2009. Author's estimates.

Table 3.2. Demographics by sector

	Public (1)	Private (2)	Difference (Public-Private) (3)	
Age	42.465	35.010	7.455	***
	6,211	27,787		
% Male	48.559	71.537	-22.978	***
	(49.983)	(48.036)	(0.646)	
% Female	51.441	28.463	22.978	***
	(49.983)	(45.125)	(0.646)	
% Single	18.628	36.121	-17.493	***
	(38.937)	(48.036)	(0.653)	
% Married	74.561	58.984	15.577	***
	(43.555)	(49.187)	(0.677)	
% Widowed	4.878	2.717	2.161	***
	(21.543)	(16.258)	(0.243)	
% Separated	1.932	2.134	-0.202	
	(13.766)	(14.452)	(0.201)	
Family size	5.267	5.517	-0.250	***
	(2.153)	(2.271)	(3.158)	
% College graduates	55.080	14.903	40.177	***
	(49.745)	(35.612)	(0.542)	
No. of observations	6,211	27,787		

Notes:

1. Standard errors are in parentheses.
2. Statistical significance is indicated by *** (α=1%), ** (α=5%), * (α=10%).

Source: Merged LFS and FIES 2009. Author's estimates.

Table 3.3. Cross-correlations between hourly wages and demographic factors

	Hourly wage
Age	0.1143
Male	-0.0602
Female	0.0602
Single	-0.0673
Married	0.0643
Widowed	-0.0008
Separated	0.0053
Family size	-0.0198
College graduate	0.3253

Source: Merged LFS and FIES 2009. Author's estimates.

Table 3.4. OLS estimates of public-private wage differentials by occupation group

Dependent variable ln(hourly wage)	Without region FE (1)	With region FE (2)
Leaders	0.209 ***	0.336 ***
	(0.042)	(0.040)
	0.000	0.000
Professionals	0.148 ***	0.275 ***
	(0.022)	(0.022)
	0.000	0.000
Associates	-0.039	0.058
	(0.038)	(0.036)
	0.304	0.113
Clerks	-0.143 ***	-0.018
	(0.023)	(0.021)
	0.000	0.411
Service workers	0.224 ***	0.254 ***
	(0.030)	(0.030)
	0.000	0.000
Agriculture workers	0.182	0.139
	(0.117)	(0.159)
	0.121	0.382
Craft workers	-0.039	0.058
	(0.058)	(0.053)
	0.494	0.271
Unskilled workers	0.159 ***	0.113 ***
	(0.024)	(0.024)
	0.000	0.000
Unclassified workers	-0.023	-0.010
	(0.237)	(0.236)
	0.922	0.967
Demographics	Yes	Yes
Skill level	Yes	Yes
Skill types	Yes	Yes
Occupation fixed effects	Yes	Yes
Region fixed effects	No	Yes
Constant	Yes	Yes
No. of observations	29,133	29,133
Adj. R-squared	0.431	0.504

Notes:

1. Statistical significance is indicated by *** (α=1%), ** (α=5%), * (α=10%).
2. Heteroskedasticity-robust standard errors are in parentheses.
3. P-values are reported below the standard errors.
4. Reference occupation group: Operators

Table 3.5. Consumption per capita in 2009, by region

Region	Regional Average / National Average
National Capital Region	186%
Cordillera Administrative Region	96%
Ilocos	91%
Cagayan	83%
Central Luzon	107%
CALABARZON	118%
MIMAROPA	74%
Bicol	75%
Western Visayas	83%
Central Visayas	84%
Eastern Visayas	77%
Zamboanga	64%
Northern Mindanao	75%
Davao	80%
SOCCSKSARGEN	76%
CARAGA	65%
ARMM	46%

Source: National Statisical Coordination Board

Table 3.6. Geographic distribution of associates, clerks and craft workers (% distribution by region)

Region	Associates		Clerks		Craft Workers	
	Public	Private	Public	Private	Public	Private
National Capital Region	8.69	28.31	13.57	31.52	12.15	17.60
CAR	5.11	3.84	5.21	2.22	3.74	3.60
Ilocos	4.77	4.55	3.91	3.60	5.61	5.19
Cagayan	3.92	2.83	4.45	2.05	4.67	3.04
Central Luzon	6.13	6.47	6.84	10.84	4.67	12.39
CALABARZON	7.33	15.27	5.97	13.73	3.74	14.34
MIMAROPA	4.77	1.92	5.86	1.80	2.80	2.79
Bicol	6.64	2.63	5.75	3.06	4.67	5.14
Western Visayas	6.64	4.65	6.19	5.36	11.21	4.99
Central Visayas	7.33	8.29	5.86	7.58	8.41	10.23
Eastern Visayas	5.96	2.83	5.54	2.60	8.41	2.63
Zamboanga	4.26	2.02	4.89	2.09	4.67	3.17
Northern Mindanao	4.60	3.13	7.06	3.64	8.41	4.00
Davao	8.69	5.97	3.69	4.81	5.61	4.15
SOCCSKSARGEN	7.50	3.34	4.78	2.60	1.87	3.17
CARAGA	7.33	2.33	6.73	2.01	8.41	3.27
ARMM	0.34	1.62	3.69	0.50	0.93	0.30

Source: LFS and FIES, National Statistics Office

Table 3.7. OLS estimates of public-private wage differentials, richer regions and poorer regions

Dependent variable ln(hourly wage)	Richer regions (1)	Poorer regions (2)
Leaders	0.253 ***	0.239 ***
	(0.051)	(0.076)
	0.000	0.002
Professionals	0.091 ***	0.444 ***
	(0.026)	(0.044)
	0.000	0.000
Associates	-0.087 **	0.302 ***
	(0.043)	(0.077)
	0.045	0.000
Clerks	-0.106 ***	0.070 *
	(0.028)	(0.038)
	0.000	0.071
Service workers	0.149 ***	0.530 ***
	(0.036)	(0.052)
	0.000	0.000
Agriculture workers	0.004	0.534 ***
	(0.114)	(0.095)
	0.972	0.000
Craft workers	0.015	-0.045
	(0.064)	(0.106)
	0.810	0.672
Unskilled workers	0.152 ***	0.154 ***
	(0.030)	(0.040)
	0.000	0.000
Unclassified workers	-0.159	0.512
	(0.348)	(0.316)
	0.647	0.106
Demographics	Yes	Yes
Skill level	Yes	Yes
Skill types	Yes	Yes
Occupation fixed effects	Yes	Yes
Constant	Yes	Yes
No. of observations	20,273	8,860
Adj. R-squared	0.429	0.466

Notes:

1. Statistical significance is indicated by *** (α=1%), ** (α=5%), * (α=10%).
2. Heteroskedasticity-robust standard errors are in parentheses.
3. P-values are reported below the standard errors.
4. Reference occupation group: Operators

Table 3.8. OLS estimates of public-private wage gap by gender

Dependent variable ln(hourly wage)	Male (1)	Female (2)
Leaders	0.206 ***	0.461 ***
	(0.059)	(0.050)
	0.001	0.000
Professionals	0.132 ***	0.346 ***
	(0.038)	(0.027)
	0.001	0.000
Associates	0.064	0.070
	(0.048)	(0.053)
	0.184	0.188
Clerks	-0.077 **	0.035
	(0.032)	(0.028)
	0.017	0.216
Service workers	0.254 ***	0.157 **
	(0.032)	(0.073)
	0.000	0.033
Agriculture workers	0.130	--
	(0.146)	
	0.373	
Craft workers	0.042	-0.512 ***
	(0.052)	(0.088)
	0.417	0.000
Unskilled workers	0.134 ***	0.030
	(0.024)	(0.062)
	0.000	0.633
Unclassified workers	-0.057	-0.019
	(0.259)	(0.617)
	0.826	0.976
Demographics	Yes	Yes
Skill level	Yes	Yes
Skill types	Yes	Yes
Occupation fixed effects	Yes	Yes
Constant	Yes	Yes
No. of observations	19,371	9,762
Adj. R-squared	0.468	0.563

Notes:

1. Statistical significance is indicated by *** (α=1%), ** (α=5%), * (α=10%).
2. Heteroskedasticity-robust standard errors are in parentheses.
3. P-values are reported below the standard errors.
4. Reference occupation group: Operators
5. The sub-group of female agriculture workers is omitted due to insufficient sample size.

Table 3.9. Employee's probability of being in the public sector, marginal effects of skill level and skill types

Dependent Variable Pr(employee=public)	College graduates	Education degree	Arts degree	Social science degree	Physical science degree	Engineering degree	Agriculture degree	Health science degree	Services degree
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Leaders	0.345 ***	-0.072 *	--	-0.191 ***	-0.186 ***	-0.228 ***	-0.183 ***	-0.021	-0.195 ***
	(0.038)	(0.039)		(0.035)	(0.060)	(0.037)	(0.060)	(0.099)	(0.050)
	0.000	0.065		0.000	0.002	0.000	0.002	0.832	0.000
Professionals	0.042	0.225 ***	-0.245 ***	-0.041	-0.053	-0.027	0.045	--	0.037
	(0.071)	(0.044)	(0.085)	(0.048)	(0.059)	(0.046)	(0.064)		(0.059)
	0.549	0.000	0.004	0.391	0.361	0.560	0.482		0.531
Associates	0.098	0.000	-0.086	-0.072	-0.113	-0.024	0.164	-0.224	0.071
	(0.107)	(0.118)	(0.147)	(0.108)	(0.128)	(0.110)	(0.120)	(0.197)	(0.125)
	0.357	0.997	0.559	0.505	0.377	0.830	0.172	0.257	0.569
Clerks	0.158 *	-0.073	-0.143	-0.073	-0.095	-0.100	0.042	-0.052	-0.087
	(0.083)	(0.087)	(0.162)	(0.084)	(0.088)	(0.087)	(0.099)	(0.121)	(0.090)
	0.059	0.402	0.378	0.384	0.283	0.248	0.673	0.665	0.332
Service workers	0.198 ***	-0.030	0.027	-0.102	-0.082	-0.060	-0.206 **	--	0.089
	(0.075)	(0.081)	(0.111)	(0.078)	(0.086)	(0.081)	(0.085)		(0.078)
	0.009	0.706	0.810	0.191	0.336	0.457	0.016		0.255
Craft workers	0.093 **	--	--	-0.050	-0.037	-0.058	--	--	-0.063
	(0.042)			(0.045)	(0.047)	(0.043)			(0.049)
	0.025			0.273	0.434	0.178			0.203
Operators	0.054	-0.029	--	-0.014	-0.008	-0.026	0.012	--	--
	(0.033)	(0.056)		(0.039)	(0.059)	(0.043)	(0.066)		
	0.101	0.609		0.723	0.893	0.546	0.849		
Unskilled workers	0.244 ***	-0.163 **	--	-0.128	-0.192 **	-0.151 **	-0.158 **	--	-0.194 ***
	(0.069)	(0.075)		(0.072)	(0.078)	(0.074)	(0.079)		(0.073)
	0.000	0.029		0.073	0.014	0.041	0.047		0.008

	Leaders	Professionals	Associates	Clerks	Service w.	Craft w.	Operators	Unskilled w.
No. of observations	1,076	2,979	1,576	3,310	4,866	3,936	2,830	11,929
Pseudo R-squared	0.346	0.280	0.216	0.165	0.258	0.091	0.107	0.088

Notes:

1. Reference group: General college degree for skill types, Non-college degree for skill level
2. Agriculture workers and unclassified workers are omitted due to insufficient sub-sample sizes.
3. Statistical significance is indicated by *** (α=1%), ** (α=5%), * (α=10%).
4. Unconditional standard errors are in parentheses.
5. P-values are reported below the standard errors.

Table 3.10. OLS estimates of difference in no. of hours worked between public and private employees

Dependent variable No. of hours	Hours worked diff. (1)
Leaders	-2.341 ***
	(0.696)
	0.001
Professionals	-0.696 *
	(0.386)
	0.072
Associates	-4.652 ***
	(0.709)
	0.000
Clerks	-4.534 ***
	(0.370)
	0.000
Service workers	-10.46 ***
	(0.680)
	0.000
Agriculture workers	5.925
	(10.143)
	0.559
Craft workers	-1.895 **
	(0.772)
	0.014
Unskilled workers	-0.162
	(0.497)
	0.745
Unclassified workers	0.422
	(3.189)
	0.895
Demographics	Yes
Skill level	Yes
Skill types	Yes
Occupation fixed effects	Yes
Region fixed effects	Yes
Constant	Yes
No. of observations	33,998
Adj. R-squared	0.102

Notes:

1. Statistical significance is indicated by *** (α=1%), ** (α=5%), * (α=10%).
2. Heteroskedasticity-robust standard errors are in parentheses.
3. P-values are reported below the standard errors.
4. Reference occupation group: Operators

Table 3.11. OLS estimates of differentials in giving behaviour between public and private employees

Dependent variable ln(gifts)	Gifts given (1)	Gifts received (2)	Net gifts given (3)
Leaders	0.465 ***	0.048	0.248
	(0.119)	(0.144)	(0.162)
	0.000	0.738	0.126
Professionals	0.256 ***	-0.031	0.070
	(0.063)	(0.079)	(0.087)
	0.000	0.698	0.419
Associates	0.303 ***	-0.070	0.238 *
	(0.094)	(0.110)	(0.143)
	0.001	0.521	0.096
Clerks	0.147 **	0.106	0.266 **
	(0.067)	(0.076)	(0.106)
	0.027	0.163	0.012
Service workers	0.250 ***	-0.132 *	0.024
	(0.074)	(0.077)	(0.120)
	0.001	0.086	0.845
Agriculture workers	0.482	-1.008 *	-0.945
	(0.568)	(0.606)	(0.854)
	0.396	0.096	0.268
Craft workers	0.299 **	0.181	-0.267
	(0.138)	(0.155)	(0.368)
	0.030	0.242	0.468
Unskilled workers	0.406 ***	0.137 **	0.218 *
	(0.069)	(0.068)	(0.127)
	0.000	0.044	0.085
Unclassified workers	1.581 ***	-1.013 *	1.481
	(0.559)	(0.520)	(0.940)
	0.005	0.051	0.115
Hourly wage rate	Yes	Yes	Yes
Demographics	Yes	Yes	Yes
Skill level	Yes	Yes	Yes
Skill types	Yes	Yes	Yes
Occupation fixed effects	Yes	Yes	Yes
Region fixed effects	Yes	Yes	Yes
Constant	Yes	Yes	Yes
No. of observations	24,479	25,079	9,849
Adj. R-squared	0.321	0.046	0.210

Notes:

1. Statistical significance is indicated by *** (α=1%), ** (α=5%), * (α=10%).
2. Heteroskedasticity-robust standard errors are in parentheses.
3. P-values are reported below the standard errors.
4. Reference occupation group: Operators

Table 3.12. OLS estimates of differentials in risk-taking behaviour between public and private employees

Dependent variable ln(consumption)	Tobacco (1)	Alcoholic beverages (2)
Leaders	-0.047	-0.312 **
	(0.185)	(0.159)
	0.799	0.050
Professionals	-0.094	-0.149 *
	(0.099)	(0.078)
	0.345	0.058
Associates	0.130	-0.002
	(0.131)	(0.116)
	0.322	0.986
Clerks	-0.051	0.037
	(0.083)	(0.072)
	0.539	0.606
Service workers	0.074	0.136 **
	(0.083)	(0.067)
	0.372	0.040
Agriculture workers	0.292	0.126
	(0.195)	(0.557)
	0.135	0.821
Craft workers	0.068	0.161
	(0.124)	(0.135)
	0.581	0.234
Unskilled workers	0.004	0.120 *
	(0.070)	(0.066)
	0.958	0.071
Unclassified workers	-0.086	0.137
	(0.539)	(0.417)
	0.873	0.742
Hourly wage rate	Yes	Yes
Demographics	Yes	Yes
Skill level	Yes	Yes
Skill types	Yes	Yes
Occupation fixed effects	Yes	Yes
Region fixed effects	Yes	Yes
Constant	Yes	Yes
No. of observations	20,066	21,248
Adj. R-squared	0.098	0.086

Notes:

1. Statistical significance is indicated by *** (α=1%), ** (α=5%), * (α=10%).
2. Heteroskedasticity-robust standard errors are in parentheses.
3. P-values are reported below the standard errors.
4. Reference occupation group: Operators

Table 3.13. OLS estimates of public-private wage differentials by occupation group, full sample vs. occupation group sub-samples

Dependent variable ln(hourly wage)	Full sample	Occupation group sub-samples		
		Estimates	No. of observations	Adj. R-squared
	(1)	(2)	(3)	(4)
Leaders	0.336 ***	0.178 ***	1,051	0.289
	(0.040)	(0.053)		
	0.000	0.001		
Professionals	0.275 ***	0.156 ***	2,904	0.211
	(0.022)	(0.024)		
	0.000	0.000		
Associates	0.058	-0.011	1,226	0.268
	(0.036)	(0.041)		
	0.113	0.787		
Clerks	-0.018	0.009	2,917	0.297
	(0.021)	(0.023)		
	0.411	0.686		
Service workers	0.254 ***	0.213 ***	4,205	0.362
	(0.030)	(0.033)		
	0.000	0.000		
Agriculture workers	0.139	-0.123	220	0.263
	(0.159)	(0.123)		
	0.382	0.320		
Craft workers	0.058	0.025	3,964	0.254
	(0.053)	(0.051)		
	0.271	0.626		
Operators	*reference group*	0.008	1,868	0.179
		(0.046)		
		0.854		
Unskilled workers	0.113 ***	0.149 ***	10,378	0.193
	(0.024)	(0.024)		
	0.000	0.000		
Unclassified workers	-0.010	0.314	56	0.257
	(0.236)	(0.449)		
	0.967	0.489		
Demographics	Yes	Yes		
Skill level	Yes	Yes		
Skill types	Yes	Yes		
Occupation fixed effects	Yes	Yes		
Region fixed effects	Yes	Yes		
Constant	Yes	Yes		
No. of observations	29,133			
Adj. R-squared	0.504			

Notes:

1. Column (1) reproduces full-sample estimates from Table A4 column (2).
2. Statistical significance is indicated by *** (α=1%), ** (α=5%), * (α=10%).
3. Heteroskedasticity-robust standard errors are in parentheses.
4. P-values are reported below the standard errors.

Table 3.14. PSM estimates of public-private wage differentials, by occupation group sub-samples

Outcome variable ln(hourly wage)	Propensity score matching				Estimates
	Standardized bias, means	Pseudo R-sq.	No. of observations on common support		Average treatment effect on the treated (ATT)
			Treated	Untreated	
	(1)	(2)	(3)	(4)	(5)
Leaders	7.440	0.373	201	834	N.A.
	(5.85)				
Professionals	3.371	0.286	1,760	1,123	0.285 ***
	(3.736)				(0.045)
Associates	4.411	0.238	424	796	0.053
	(4.155)				(0.060)
Clerks	2.293	0.199	789	2,103	0.082 ***
	(2.091)				(0.031)
Service workers	3.668	0.300	637	3,550	0.303 ***
	(3.230)				(0.044)
Agriculture workers	8.336	0.251	3	41	N.A.
	(24.047)				
Craft workers	3.862	0.090	102	3,747	0.004
	(3.613)				(0.063)
Operators	3.739	0.125	149	1,681	(0.030)
	(2.620)				(0.051)
Unskilled workers	2.266	0.084	554	9,820	0.154 ***
	(1.659)				(0.026)
Unclassified workers	N.A.				N.A.

Notes:

1. Column (1) indicates match quality of propensity scores based on standardized bias. As a rule of thumb, I did not report ATT estimates when the standardized bias is above 5% (Caliendo and Kopeinig, 2008) because ATT estimates cannot be considered valid when propensity score matching was not sufficiently achieved.
2. Column (2) indicates match quality based on the Pseudo R-squared. Low values indicate good match quality.
3. I used the nearest 5 neighbors with replacement for the matching algorithm.
4. Treated group refers to public employees; Untreated group refers to private employees
5. Statistical significance is indicated by *** (α=1%), ** (α=5%), * (α=10%).
6. Standard errors are in parentheses.

Figure 3.1. Public-private wage gap by age bracket

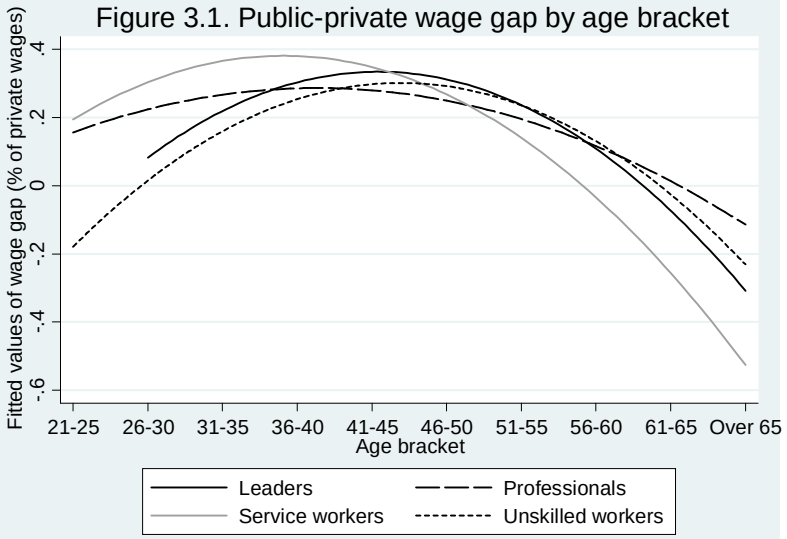


Figure 3.2. Public-private wage gap and effort gap

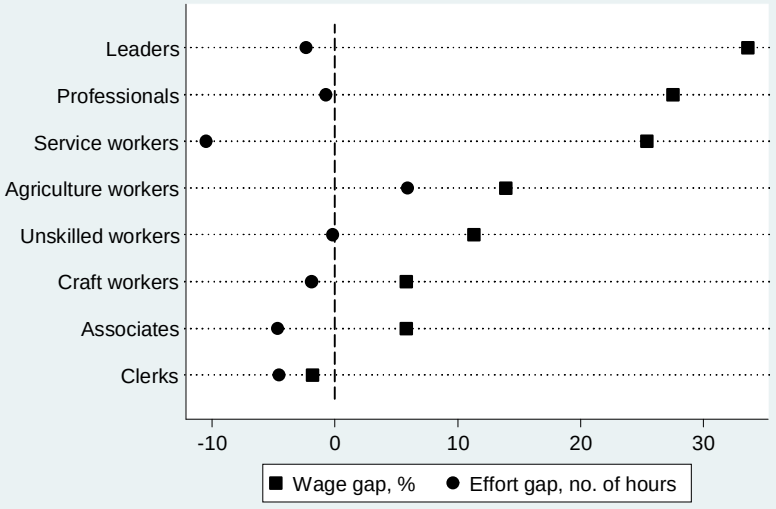


Figure 3.3. Public wage premium and pro-social premium

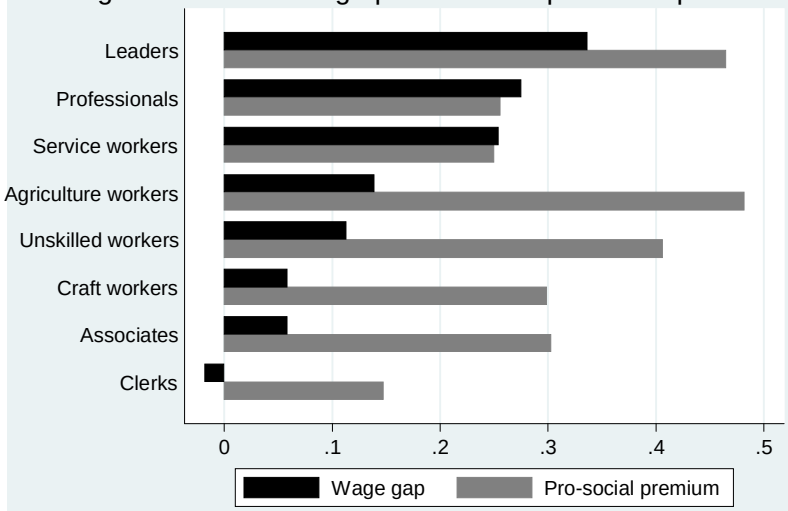
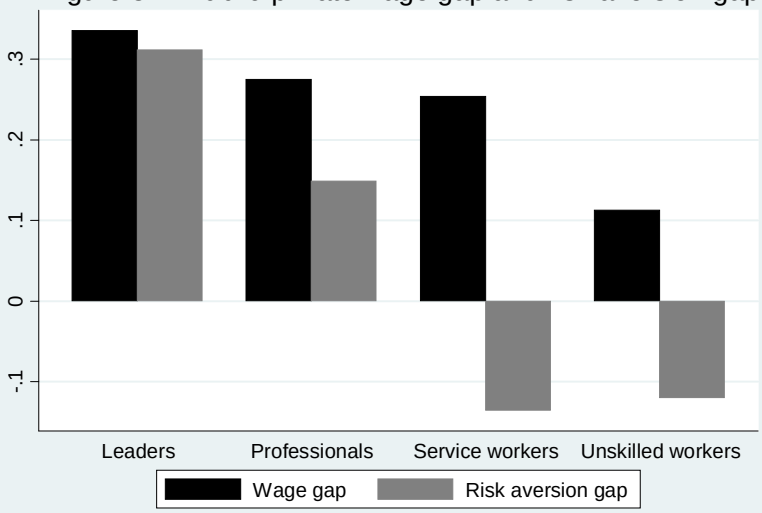


Figure 3.4. Public-private wage gap and risk aversion gap



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