Volume LVII No. 1

ISSN 1655-1516
June 2020

The Philippine Review of Economics

ARTICLES IN THIS ISSUE

A joint publication of the
University of the Philippines School of Economics
and the **Philippine Economic Society**

The Philippine Review of Economics

A joint publication of the UP School of Economics (UPSE)
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Acknowledgements: The PRE gratefully acknowledges the financial support towards its publication provided by the Philippine Center for Economic Development (PCED). The Review nonetheless follows an independent editorial policy. The articles published reflect solely the editorial judgement of the editors and the views of their respective authors.

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The Philippine Review of Economics

Vol. LVII No. 1
June 2020

ISSN 1655-1516
DOI: 10.37907/ERP0202J

The Philippine Review of Economics
57(1): 1-17. DOI: 10.37907/1ERP0202J

Clubs, Coase, and the role of government

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As Ronald Coase and others have shown, deducing the appropriate role of the government in the economy requires a *comparative institutions* approach. Trying to generalize from oversimplified specifications regarding transaction costs, according to whether exclusion is possible or not, is a futile exercise. An alternative to the *Ostrom matrix* is to distinguish private, club, and collective consumption goods according to their technical characteristics, specifically their degree of congestabiilty. The other box of the Ostrom matrix, "common pool" resources, can also be usefully analyzed from a club perspective. Spillover goods are spatial clubs. Lastly, a version of the Coase theorem is offered, which provides the foundation of comparative institutional analysis.

JEL classification: H4
Keywords: Public goods, club goods, congestability, Ostrom matrix, comparative institutions

1. Introduction

Public goods and the Coase theorem are two of the most confusing parts of any text or curriculum about public economics. At least some of the confusion can be resolved by applying the concept of the shrinking core and by more clearly separating first-best efficiency conditions from second-best matters of implementation. The resulting framework helps to clarify the role of government in an economy.

2. Public goods

It is commonplace to define public goods by the characteristics of non-rivalry and non-excludability. This tradition was established by Musgrave [1939], who even Samuelson described as "undoubtedly *the* authority in the whole field of public finance" [Desmarais-Tremblay 2017]. Yet non-excludability is not featured in Samuelson's [1954] *The Pure Theory of Public Expenditure*. Musgrave

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eventually acceded to the primacy of non-rivalry (Musgrave [1969]; Desmarais Tremblay [2017]) but nonetheless helped to promulgate the now famous two-by-two taxonomy of goods according to rivalry in consumption and the feasibility of exclusion (Musgrave and Musgrave [1973], hereafter M & M).

In M&M's 2x2 diagram, the rows are labeled rival and non-rival and the columns according to whether exclusion is feasible or not. Ostrom and Ostrom [1977] named M&M's four categories as:

1. Rival/excludable: *Private Good*
2. Rival/non-excludable: *Common Pool Resource*
3. Non-rival/excludable: *Toll Good* (changed to *Club Good* e.g. in Ostrom [1990])
4. Non-rival/non-excludable: *Public Good*

Similar diagrams appear in many textbooks,[1] in spite of Samuelson's objections. The problem with the names is that they conflate the characteristics of the good with organizational form. As Coase [1937; 1960; 2012] famously explained, however, different organizational forms are capable of achieving the same efficient solution absent transaction costs (see also Arrow [1969]). Therefore, there is no unique mapping from good characteristics to the optimal mode of provision. Monitoring, enforcement, and other transaction costs must be considered in tandem with characteristics of the good to determine which organizational form is appropriate for which good in what transaction cost environment. For example, natural resources, whose stock is given by nature and may be depleted over time, can, under different transaction cost conditions, be efficiently organized as private property, central government management, common property (*res communes*), and even no property (*res nullius*).[2]

Samuelson [1954] found non-excludability unnecessary for his derivation of efficiency conditions and tried on multiple occasions to convince Musgrave to drop exclusion from his taxonomy.[3] His formalization of non-rivalry has the total quantity of the good produced as an argument in the utility function of all individuals, leading him to use the term "collective consumption good" instead of "public good", and rendering non-excludability redundant. This does not mean that excludability is irrelevant, but its relevance is manifested at a different level of analysis, one with transaction costs.[4] Excludability, a feature of property rights, is just one of many possible enforcement mechanisms.

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[1] See e.g. Hindriks and Myles [2013]. Categories 2 and 3 are sometimes called "impure public goods".

[2] See the penultimate section, Common Property Resources.

[3] Desmarais-Tremblay [2017] details the intellectual history of public goods, including discussions and correspondence between Musgrave and Samuelson. Musgrave [1969] accepted the primacy of Samuelson's jointness in consumption over non-excludability on the grounds that even if tolling is possibly on an uncrowded bridge, exclusion would be inefficient, i.e. the optimal toll would be zero. Musgrave and Musgrave [1973] also qualify their two-by-two diagram, noting: "It is customary, however, to reserve the term for case 3 and 4, i.e., situations of nonrival consumption" (as quoted in Desmarais-Tremblay [2017]). See also Samuelson [1969] for an elaboration of his earlier views.

[4] See e.g. Roumasset [1978] and Dixit [1999] on the 1st, 2nd, and 3rd-best levels of analysis.

3. Collective consumption, clubs, and congestability

As an alternative to the Musgrave-Ostrom matrix,[5] we seek a classification of public, private and club goods that is independent of transaction cost issues such as excludability. To that end, we can subsume collective-consumption and private goods as special cases of club goods according to their degree of congestability. Club goods are characterized by congestion as new members are added to the club. Collective-consumption goods are the limiting case of club goods where congestion costs are zero. Private goods represent the other polar extreme of club goods, where congestion costs of one consumer are so high as to be strictly subtractive, i.e. another consumer's consumption of the good reduces mine to zero [Smith 2014].

In his original theory of clubs, Buchanan [1965] considered a club good of fixed size, e.g. a swimming pool, and defined optimal club membership as that number that minimizes the sum of long-run capital and operating costs plus congestion costs (lost benefits), both per member. The number of competing clubs is then given by the number of potential members (e.g. population) divided by the optimal membership size. While not using the same terminology, Tiebout [1956] asserted that consumer mobility and competition between clubs would then lead to an efficient solution with homogenous membership in each club. This led him to conclude that decentralized pricing is hypothetically capable of achieving efficiency, despite Samuelson's [1954] assertion to the contrary.

Extending Buchanan's [1965] theory to the case of endogenous production, the club model can be derived as follows. The utility of an individual member is given by $U(Y,S,n)$, where Y is consumption of the numeraire good, S, is production and consumption of the club/social good, and n is number of members in the club. The consumer spends her endowment, Y_0, on Y and her contribution to S, $C(S)/n$. The necessary condition for optimality with respect to the quantity of the social good in each club is that the aggregate marginal benefit of the club's membership is equal to the marginal cost of producing the good, i.e. $nU_S/U_Y = MC_S$, the well-known *Samuelson condition*. The condition for the optimal number of members in a club is that the marginal benefit of adding an additional member is equal to its marginal cost. The marginal benefit to a representative member is the marginal cost reduction per person. The marginal cost is the increased congestion cost, i.e. $C(S)/n^2 = -U_n/U_Y$.[6]

[5] See de Dios [2015] for an extension of the Ostrom two-by-two table to a two-by-three table including externalities.

[6] Note that the derivative (with respect to n) of the cost per member, $C(S)/n$, is $-C(S)/n^2$. Since the additional cost is negative, the cost reduction (benefit) is positive, i.e. without the minus sign. See Hindriks and Myles [2013] and Cornes and Sandler [1996] for more conventional derivations.

The greater the marginal disutility of congestion, the smaller is the optimal club size. If $C(S^*) \leq -U_n/U_Y$ for any $n \geq 1$, then we have a corner solution with one member per club, i.e. a private good.[7] If there is no congestion such that the marginal disutility of an additional member is zero, the efficiency conditions call for the opposite polar extreme: one club optimally serving the entire population. We can therefore classify goods entirely based on congestion costs. Private and collective-consumption goods represent the two polar extremes of prohibitive congestion and no congestion. While these extremes are formally special cases of club goods, it is convenient to think of club goods as the intermediate category where there is an internal solution and the optimal number of clubs is between one and the number of consumers.

Only in turning to questions of implementation do we find a role for exclusion. If clubs are able to enforce payment by the mechanism of exclusion, then they can compete for membership. As the population divided by the number of consumer types increases, the set of undominated solutions (the core of the economy) shrinks to the Lindahl equilibrium with homogeneous membership in each of the clubs. With constant returns to scale, this is achieved with members of each club paying an equal share of the costs, thereby proving the Tiebout hypothesis (Wooders [1980; 1989]; Conley and Wooders [2010]). Clubs are typically conceived as voluntary associations, although the Tiebout proposition was originally intended and has subsequently been used as the basis of a theory of local government expenditures.[8]

For Samuelson's [1954] collective consumption goods, the cost of adding an additional member to a club is zero, and the optimal number of clubs is one. Even if exclusion were feasible, there is a natural monopoly. If multiple clubs tried to compete for membership, the largest club (with the lowest average cost) could sell at the lowest price, drive out competition, and then raise the cost of membership, thus inefficiently limiting consumption. While private enterprise can produce and sell the good, regulation is needed to lower price and increase quantity. And if exclusion is not possible, the state needs a different enforcement mechanism, namely taxation authority and penalties for tax evasion in order to provide for the public welfare. Either way, the government contracts with the private sector on behalf of its citizens. Regulation and other aspect of extra-market government provision are thus aptly described as "administered contracts" [Goldberg 1976].

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[7] For rival goods bilateral contracting between suppliers and consumers leads to the usual competitive result, which, absent externalities, is efficient. Formally, the core (which is a subset of Pareto optimal points) shrinks to the competitive equilibrium as the number of traders goes to infinity. Note that if we define competitive equilibrium as what the core shrinks to, thus rendering the fiction of a Walrasian auctioneer unnecessary, the First Fundamental Theorem of welfare economics is true by definition. In his Principles text Nobel Laureate Edmund Phelps [1985] argues that this is a more natural approach to the study of markets. Coase [1960, 1990] essentially takes this result for granted in referring to a *competitive contractual equilibrium* as a *market*.

[8] Local public goods are spatial clubs, where the marginal benefits of membership decline spatially, moving away from the center of provision (e.g. a firehouse) and typically falling to zero outside of jurisdictional boundaries (e.g. Hochman [2011]).

In general, first-best regulation of a natural monopoly can be achieved by a two-part tariff: Charge the marginal cost of increasing service and make up the revenue loss with lump-sum finance. For a pure collective-consumption good, the marginal cost of serving an additional customer is zero so the two-part tariff collapses to one part, the lump-sum charge. The personalized prices of Lindahl's benefit taxation scheme [Lindahl 1958] are but one form of lump sum charges inasmuch as the individual does not choose the quantity of the good to be consumed and the personized prices (taxes) are non-voluntary.[9]

The intermediate case between many clubs and a single club for a collective-consumption good is that of low congestion costs and the consequent small number of clubs. Here, some central regulation may be appropriate inasmuch as some larger clubs may be able to recruit potential members away from rival clubs, thus raising average member cost of rivals, and then extracting some amount of monopoly profits through higher fees.

While Musgrave was attempting to identify conditions of market failure and the need for public intervention, it is now understood that articulating the "first-best" theory in the absence of transaction costs is only a first step in designing the role of government. Alternative institutions can then be chosen according to their comparative agency costs, the sum of information and enforcement expenditures and the residual losses, measured according to the departure from the first-best solution.[10] Trying to categorize goods according to an oversimplified characterization of transaction costs, e.g. whether exclusion is possible or not, is likely to give a misleading portrayal of government's role. This perspective is elaborated in more detail in the subsequent section on the Coasean equivalence theorem.

4. Common pool resources

The juxtaposition of "common" along with "pool resources" also runs the risk of confounding organizational form with characteristics of the good in question. But this time, we can imagine a resource pool (literally a pool of oil or an aquifer) that is common to many overlying users such that the name can be taken to refer to the characteristics of the good and the locations of potential extractors. In that sense, common pool resources are naturally associated with the *commons dilemma*, the incentive for many extractors to excessively deplete the resource absent property rights, central government, or community regulation. First-best management requires extraction up to the point where the marginal benefit (price) is equal to the full marginal cost (including marginal user cost). The commonality between Ostrom's [1965; 1990] groundwater and Libecap's [1998] oil is that there

[9] Lindahl's scheme assesses taxes according to marginal benefit. Another candidate, sometimes attributed to Wicksell [1896], would be to tax in proportion to total benefit (consumer surplus).

[10] This definition of agency costs is due to Jensen and Meckling [1976]. For a formal demonstration showing that minimizing agency costs is equivalent to maximizing second-best welfare, see Roumasset [1995].

are multiple extractors. The difference is that Ostrom's extractors have their own demands whereas Libecap's extractors are selling to the same oil market. For the latter, club/community management determines how much to extract and allocates shares (e.g. in proportion to each owner's land area above the pool). Ostrom's community managers have the more difficult task of aggregating demands, deciding how much to extract in each period, and then dividing up responsibilities and extraction allowances. This is greatly simplified for homogenous extractors (roughly equal allocation of tasks and extraction rights).

Ostrom's insight was that private property and "Leviathan" (central government) are "not the only ways" to govern common pool resources and their tendency towards resource depletion. Rather a "hybrid" form, a club, may sometimes be more efficient [Sandler 2010]. The many examples provided by Ostrom and colleagues (e.g. Ostrom [1990]) suggest that local governance, being accountable to the people, is often more successful at sustaining the resource than private property or central government, but this is not assured. Local governance, e.g. by cooperatives, is also susceptible to rent-seeking (Hart and Moore [1996]; Banerjee et al. [2001]). Whether private, local, or central governance is second-best optimal is a matter of comparative institutions. For each form, optimal governance occurs where marginal agency cost equals the marginal reduction in the "externality" cost of departing from the first-best solution, given by $P=c+MUC$ (where P is the resource price or marginal benefit, c is extraction cost, and MUC is the marginal user cost).[11] A global comparison can then be made across the different institutions, each with its own optimal governance [Roumasset and Tarui 2010]. Borrowing Ostrom's [1990] rhetorical device, common property "is not the only way".

As with other club goods, the appropriate role of government may increase with the size of the pool. Most of the pool resources discussed in "commons" literature (e.g. Ostrom [1990]) are small, relative to the economies of which they are a part. Exceptions such as the High Plains Aquifer in the U.S. (from Texas to Wyoming and South Dakota) are less suitable for management by many competing clubs.[12]

5. Spillover goods

The term "externality" also confounds the nature of the good with economic organization. Distinguishing between *spillover goods* and *externalities* provides a clarification. Spillover goods occur as a byproduct of production and consumption. The prototypical case involves pollution emissions from the production of one

[11] See e.g. Roumasset and Wada [2015]. In the case of a non-renewable resource such as oil, MUC is given by the expected price increase divided by the discount rate.

[12] See Salant [2009] for a novel discussion of how an equal sharing rule within each club combined with competition between clubs for members can result in efficient incentives for extraction, thereby curbing the tragedy of the commons.

good entering into the production function of another good (e.g. Montgomery [1972]) or into the utility function of one or more consumers. Where these are external to markets, they are called "externalities." As Arrow [1969] emphasized, a spillover may be an externality or not, depending on the costs of alternative forms of economic organization.

Spillovers can be *internalized*, by creating a market (e.g. the market for SO2 emission permits) or by emission taxes that face producers with the added social cost imposed by their pollution. Whether it is efficient to do so and by what means is primarily a matter of transaction costs Coase [1960; 1990]. If the costs of monitoring emissions and administering a taxation or permit scheme are too high, it is possible that indirect regulations (e.g. the U.S. CAFÉ standards for the improvement of vehicle fuel economy) are more efficient.

In the typical case of pollution where there are multiple victims, the mechanism of competition across pairs of bilateral contractors does not apply since pollution is typically a collective-consumption bad. The government can act on behalf of the victims, however, by requiring polluters to have permits for emissions beyond the established baseline, thus creating a potential (one-sided) market for emission permits. Alternatively, they can impose a fee (emission tax) for pollution damages. These alternatives along with more indirect alternatives can then be subjected to comparative institutional analysis.[13]

Pollution can also be analyzed as a spatial club. One can imagine treating municipalities (or counties) as spatial clubs competing for members, thus incentivizing pollution control and inducing sorting according to preferences for clean air and water (e.g. Huang and Hua [2018]). Greenhouse gases are global public bads, i.e. the optimal number of clubs is one, bringing us back to the natural monopoly problem. Absent a world government, however, we are now in the area of fostering international cooperation, which may take the form of a club of countries sanctioning non-members (Nordhaus [2015]; Mason et al. [2017]). Where spillovers are bilateral, clubs consist of one supplier and victim (or beneficiary) each.

6. An equivalence version of the Coase theorem

The controversies and confusion surrounding the Coase theorem have been widely detailed (e.g. Medema and Zerbe [2000]). Two versions of the theorem are popularly described—the *invariance* and the *efficiency* versions. The invariance version asserts that if property rights are well-defined and transaction costs are zero, the same efficient solution will obtain regardless of liability placement. This version has been recognized as incorrect inasmuch as liability rules affect income, spending, and prices such that a different allocation is possible (e.g. Usher [1998]).

[13] Private supply of permits would not fare well in an institutional comparison due to the underprovision problem.

The invariance version can be rescued, however, by stating more fundamental restrictions that will rule income effects out, in particular that shareholders of the polluting and victim firms have quasi-linear utility functions such that prices of the outputs of the two firms will not be affected by demand effects of liability placement [Hurwitz 1995].[14]

The highly restrictive requirements of the invariance version can be viewed as motivation for an alternative version. The *efficiency version* of the Coase theorem says that only such costless bargaining will result in an efficient solution. To prove this, we need a solution concept for cooperative games, the most general of which is the *core of an economy*. But to say that the core of an economy is efficient is true by definition, since the core is a subset of Pareto efficient points. Accordingly, the efficiency version is a trivial tautology (e.g. Usher [1998]).

The key to identifying a viable theorem consistent with Coase's mission is to recognize the role of competition. Recall that in the case of club goods, efficiency only obtains (at least approximately) with many clubs in competition with one another. Examining the court cases that he described, we see that Coase [1960] was clearly focused on bilateral spillovers. In each example, there is one agent imposing costs on another single agent: Cattle trample a farmer's field; a building blocks sunlight to a neighbor's swimming pool; a confectioner's machinery interferes with the work of a neighboring dentist.[15] Coase argued that for these cases, if liability were clear, the parties involved would have been able to bargain with each other to reach an efficient contractual solution. Since the contracts are bilateral, competition is possible *ex ante* before the parties established businesses in specific locations.

According to Harold Demsetz, who attended Coase's famous 1959 University of Chicago seminar, Coase stressed the importance of ex ante competition for reaching his value-maximizing solution, even though his 1960 paper analyzes ex post, two-party court cases.[16] Nobel Laureate George Stigler, who named the Coase theorem in his microeconomics text [Stigler 1966], explicitly asserts "perfect competition" as a requirement for its domain.[17]

Just as ordinary markets emerge in a competitive contracting environment, the same is possible for the case where spillovers are bilateral. Coase's point was not that contracts will always save the day, but that government intervention, e.g. in the form of Pigouvian taxes, may not be the only or even the best way to internalize the spillover and that designing the best organizational form requires a

[14] Bergstrom [2017] subsequently generalized the Hurwitz result to a somewhat broader class of utility functions, but the invariance version still requires highly restrictive assumptions.

[15] Even the Coase's case of railroad sparks starting fires on adjacent farmers' fields can be considered bilateral in the sense that each farmer is afflicted by a separate unit of spark emissions.

[16] See Stigler [1985] for an account of Coase's seminar and subsequent dinner discussion and Roumasset [1979] for Demsetz's recollection of the importance of ex ante competition in Coase's presentation.

[17] In lieu of a proof, Stigler diagramed the Coasean equilibrium as the intersection between the marginal benefits of cattle being able to enter a farmer's field and the marginal damage costs to the farmer.

comparative institutions approach (see also Demsetz [1969]). Each institution can be compared according to its governance/agency costs and how close it comes to the first-best ideal.[18]

Cheung's [1973] documentation of apple-orchard owners contracting with beekeepers for pollination of apple blossoms provides a perfect example of *ex ante* competition. Inasmuch as there were many beekeepers and apple orchards in Washington State, this case illustrates both bilateral contracting and competition for favorable contractual terms. Cheung's [1968] case of share tenancy in Taiwan provides another excellent example. The Cheungian version of the Coase theorem is that competition for bilateral contracts results in an equivalency with the competitive equilibrium. Cheung did not do so, but the proposition can be proved using the core of an economy, since the core shrinks to the competitive equilibrium as the number of contractual pairs approaches infinity [Johansson and Roumasset 2002].[19,20] That is, competition for the best contractual terms produces prices and quantities, as if there were a competitive labor or land rental market in the case of share tenancy and a market for pollination services for the apple-honey economy. While Coase eschewed formalization, he clearly understood this intuition and frequently described the competitive contracting solution as a market.

As usual, the proof clarifies the restrictive assumptions needed for the proposition to be strictly true, in particular the requirement for competition among pairs of bilateral contractors. Of course, the number of pairs never reaches infinity, but under plausible conditions the core shrinks quite rapidly. [21,22]

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[18] See e.g. Roumasset [1995] for a formalization of the comparative institutions approach.

[19] Bees are a joint input to the production of both honey and apples, analogous to the formulation of Montgomery [1972] who puts emissions into the production function of a consumable good. Absent non-convexities, the core shrinks as competition increases and the equivalence between competitive contracting and a Walrasian equilibrium is established.

[20] Johansson and Roumasset [2002] prove that the core of an apple-honey economy shrinks to the competitive equilibrium with a market for pollination. Johansson [1996] also proves that the core of an economy with negative bilateral spillovers shrinks to the competitive equilibrium with an emissions market as the number of bilateral pairs goes to infinity.

[21] In Roumasset [1979], I noted the applicability of the Debreu-Scarf Theorem to simple share tenancy and production externality economies. The application to a share tenancy economy shows that the core shrinks rapidly. For example, with only three landlords and three tenants, the core does not contain any shares that are more than 10 percent away from the competitive equilibrium equivalent. In an apple-honey economy, the core with 10 pairs of traders is within plus or minus 3 percent of the competitive equilibrium [Johansson and Roumasset 2002]. Accordingly, the core can be used to show the limits of market power. On the other hand, if there were only a few landlords or orchard owners, they could potentially agree to offer only exploitative contracts.

[22] Foley [1967] and Aivazian and Callen [1981] have provided examples where the core of a production spillover economy is empty, but these were not bilateral contracting economies. They also implicitly involved inconsistent definitions of property rights. As shown in Bergstrom [1975], where there is jointness in the consumption of a negative spillover, the core still contains the Lindahl solution. The problem is that the core does not shrink. As members are added to the coalition, benefits increase but costs do not. Since *agreers' surplus* increases as new members are added, it becomes ever more difficult to block the many ways of sharing the surplus. That is, the core *grows* instead of shrinking, admitting more and more solutions besides the Lindahl equilibrium [Pauly 1967].

Since the core of a bilateral contracting economy shrinks to a competitive equilibrium with universal markets, these solutions are equivalent allocations. As is well-known, the Pigouvian tax/subsidy solution in a world of zero transaction costs is also equivalent. This result provides an *equivalence version* of the Coase theorem. Since contracts, the market, and the Pigouvian solution under competition and absent transaction costs all achieve the same efficient solution, the upshot of the equivalence version is that any meaningful comparisons between the different policy designs can only be made through a consideration of transaction costs, i.e. in a *comparative institutions* framework [Demsetz 1969].[23]

The equivalence version satisfies a Coasean agenda: First, it effectively undermines the proposition that Pigouvian taxes are the only or even the best way to restore efficiency in an economy with externalities, clearly an important part of Coase's [1960] motivation. Second, the equivalence proposition serves as a starting point for law and economics and serves as a pillar of the new institutional economics. The equivalent solution, which Coase refers to as the value maximum, becomes the benchmark by which other institutions can be measured. Third, the equivalency result undergirds Coase's [1937] proposition that the boundaries of the firm are chosen to minimize transaction costs, if we take transaction costs to be a general category that includes the contracting costs of dealing with an outside supplier and the agency costs of internal firm governance. Aside from these costs, locating a supplier such as Fisher Body outside of General Motors (GM) or vertically integrated inside of GM would be equivalent.[24]

Coase [1960] also introduced the notion of reciprocal causation of harm. While the railroad sparks may destroy some crops, the damages were only possible because the farmer planted close to the tracks. As Baumol [1972] details in his classic paper on taxation and externalities, both Coase and more forcefully Buchanan and Stubblebine argued that taxation of the emitter should therefore be accompanied by taxation of the victim, such that "all marginal externalities are eliminated". As Baumol showed in the same paper, this turns out to be a red herring. It is not necessary to determine who "caused" the externality, only to know who the generator/emitter is and who the recipient victim is. (His demonstration illustrates that *blackboard economics* is useful after all, even in clarifying the essence of Coasean economics.)

Baumol [1972] adds the proviso that a Pigouvian tax should be administered "without payment or compensation" to the victims, lest victims are motivated to shirk on avoidance expenditures. This requirement has proved to be an additional source of confusion, however. We return to the equivalence proposition for clarification. Consider the classic Spence-Zeckhauser [1974] case of Upton

[23] The comparative institutions approach should also be extended to include imperfect competition. To my knowledge this has not been achieved.

[24] For an extensive discussion of the controversy and a proposed resolution of why, in a world of transaction costs, Fisher Body was vertically integrated into GM in 1926, see Rolder [2006].

Paper Mills and Downley Baths albeit with many upstream effluent producers, who once their locations are fixed, are matched one-to-one with downstream victims of pollution. To implement a market for emission permits, the government can grant victim rights by issuing pollution permits to downstream recipients and requiring upstream polluters to obtain emission permits according to the quantity of emissions that they impose on their bilateral victim. To obtain the equivalent Pigouvian solution to a competitive permit market, the government must pay the victims compensation as if they were sellers of permits. The reason that this compensation does not distort the victim decisions is that said payment is lump sum. It is not paid according to actual damages but according to their (least) marginal damage function, which is identical to their supply of permits.[25] Similarly, if the government imposes a victim-rights liability rule, the competitive contracting equilibrium (what the core shrinks to) is equivalent to the permit-market solution with victim rights.

While the Coase solution emphasizes bargaining, i.e. is correctly analyzed via cooperative games, clear liability rules may result in an equivalent solution without bargaining. Victim rights in tort law incentivize polluters to reduce pollution up to the point where their marginal benefit of emissions equals the marginal damage cost to victims, while incentivizing victims to invest in optimal avoidance such as water filtration (Brown [1973]; Shavell [1987]).[26] That is, the equivalency of permit markets, Pigouvian incentives, Coasean bargaining can be extended to include liability rules (including negligence provisions).

Another set of equivalencies exists under polluter rights, i.e. the victim is liable for pollution damages, the polluter is endowed with emission permits in the permit market, and the polluter is subsidized for reducing pollution in the Pigouvian solution. The Pigouvian subsidy, however, is a tax in disguise, because the subsidy equals a lump-sum grant equal to the profit-maximizing amount of pollution times the market equilibrium permit price minus a Pigouvian tax on emissions. This solution is equivalent to the market solution with polluter endowment of rights and the Coasean contract solution with polluter rights.[27] In this sense, it may be misleading to speak of a Pigouvian subsidy not to pollute. What incentivizes pollution control is the explicit or implicit tax on emissions. What varies is only the baseline above which excess emissions are taxed and below which emissions are reckoned as negative (resulting in a negative tax liability).

[25] See Holtermann [1976] on compensating victims according to their marginal damage cost function and the lump-sum nature thereof.

[26] Pollution need not be portrayed as accidental in order for the non-cooperative equilibrium to be equivalent to the other solutions (e.g. Michelman [1971]).

[27] See Roumasset [1979] and Johansson and Roumasset [2002] for further discussion of the victim and polluter-rights sets of equivalencies.

Where there are multiple victims, there is no equilibrium contractual equivalent to the Pigouvian solution because the core does not shrink Bergstrom [1975; 1976] . The government can effect a market equivalent of the Pigouvian tax solution, however, by requiring polluters to purchase permits for their emission quantities. (Allocating permits to victims would run afoul of the free rider problem.) Similarly, under accident law, it would be difficult for many victims of a single polluter to form a coalition to sue the polluter. Long before the first Clean Air Act in the U.S., a small number of victims successfully sued for damages from industrial pollution. But once the victims became more diffuse, this mechanism was no longer effective.[28]

7. Conclusion

Absent transaction costs, different organizational forms are capable of achieving the same efficient solution. The role of transaction costs in determining optimal institutional structure depends on characteristics of the good in question, available mechanisms of governance, and the transaction cost environment. Simple generalizations, e.g. about whether the good is "excludable" or not, are unlikely to be fruitful. Rather, goods can be classified according to their technical characteristics and the first-best solution used as a foundation for comparative institutions. Simply put, levels of analysis should be kept distinct, but the first-best analysis can facilitate analysis at the second-best level.

The (first best) theory of clubs can be used as a unifying principle for public economics, environmental economics, and resource economics. A collective consumption good is a club good for which the optimal number of clubs is one. Private goods represent the other polar extreme, where the optimal number of clubs is the same as the total number of consumers. The reason that government intervention is called for in the case of pure collective-consumption goods is due to the natural monopoly problem, i.e. the provision of public goods can be viewed as an extension of the theory of regulation, and the role of government increases as the number of clubs decreases.

Potential extractors of pool resources can also be viewed as a club. Where resources such as trees, oil, and fish are sold into a larger market, market competition avoids the natural monopoly problem. For resources that are consumed directly such as drinking water, competition between clubs may require Tiebout mobility of consumers to effect competition. For very large pools, such as the Ogallala Aquifer, a greater role of government may be indicated. There is scant research on the interaction of multiple resource clubs, and this may prove to be a fruitful avenue to advance the Ostrom agenda.[29]

[28] Shafer [2000] argues that before the Clean Air Act, factories installed smokestacks to diffuse pollution thereby increasing coalition costs for a viable lawsuit.
[29] Salant [2009] provides a potentially useful starting point.

Spillovers can be analyzed as spatial clubs, where the optimal number of clubs again ranges from one to the number of consumers. For global public goods, such as mitigation of climate change, the optimal number of clubs is one.

Much of the confusion surrounding the Coase theorem can be resolved with the equivalence version. The equivalence version of the Coase theorem applies to bilateral spillovers such that the optimal number of clubs is equal to the number of emitter and victim pairs. It states that under victim rights and absent transaction costs, bilateral production spillovers can be equivalently internalized by markets, contracting, and Pigouvian taxes with lump-sum victim compensation. There is an analogous set of equivalencies under polluter rights. This proposition serves to promote the Coasean agenda:

1. Pigouvian taxes are not the only way to internalize spillovers [Coase 1960].
2. Since alternative solutions are capable of the same solution absent transaction costs, they can only be meaningfully compared through (second-best) comparative institutional analysis Coase [1937; 1976].
3. Whether or not a supplier of intermediate goods should be vertically integrated into the firm is an application of principle 2 [Coase 1937].
4. The first-best equivalency provides a benchmark by which institutions can be compared.[30]

The import of the Coasean equivalency, at the first-best level of abstraction, is enhanced by stripping away the red herrings of reciprocal harm and alleged moral hazard of victim compensation. The mechanism for internalizing spillovers is an emission fee, whether it takes the form of a tax, a permit price, or is built into the contract. Compensation can be made to polluters (such the net payment becomes an abatement subsidy) or to victims, but either way, the compensation is lump sum. The difficulty of knowing the marginal damage cost of pollution and the marginal benefit of emissions are issues that arise at the second-best level, in doing comparative institutional analysis.

In all of the cases examined here (clubs, spillovers, and pool resources), the optimal form of governance depends on which form can minimize agency costs by balancing the departure from the first-best equivalency solution with the economizing of agency costs. Nonetheless, some generalizations are possible. For private goods, the minimal role of government is providing Adam Smith *night-watchman* functions including the contractual infrastructure for bilateral contracting. For club goods, the contractual infrastructure must include the ability of associations to contract with the public and regulatory functions where competition is inadequate. In that sense, the role of government increases as

[30] Coase did not express this himself, concerned that "blackboard economics" often abstracts away from fundamental determinants of institutions and may obscure the ability of cooperation to internalize apparent "market failures." Nonetheless, the benchmark approach offers a method of operationalizing comparative institutional analysis including the analysis of comparative public policies [Roumasset 1995] and is therefore complementary with the rest of the agenda. It also offers a bridge to mathematical economists who are often dismissive of the Coase Theorem, e.g. Starrett's [1988:24] declaration that the Coase Theorem is a "piece of folklore".

congestion costs (and therefore competition) decline. The central government's regulatory authority for clubs naturally extends to contracting for the provision of collective consumption goods on behalf of the citizenry.

There is perhaps no such thing as a purely private good inasmuch as all goods generate some kind of spillover in their production or consumption. The decision not to regulate negligible and small spillover effects presumably reflects an implicit judgment that the increased costs of regulation are not worth the benefits.

The concept of spatial clubs can be used as the basis of an economic theory of multiple jurisdictions and of fiscal federalism. In a first-best setting, the jurisdiction for a particular spillover should be extended to internalize the spillover. This tendency should be balanced against lost Tiebout sorting, benefits of club competition, and the ability of local jurisdictions to be more responsive to local demands.

Acknowledgements: Thanks to Noel de Dios for inspiration and support and to Lee Endress, Nori Tarui, and an anonymous referee for helpful comments.

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The Philippine Review of Economics
57(1): 18-41. DOI: 10.37907/2ERP2020J

The COVID-19 pandemic, remittances and financial inclusion in the Philippines

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Recent literature has revealed that financial inclusion enhances economic opportunities and security in developing countries. Moreover, a greater inflow of remittances can promote inclusiveness. In this paper, we explore the potential impacts of the COVID-19 outbreak on financial inclusion by focusing on its detrimental effect on remittance flows to developing countries. Using a household-level dataset collected in rural regions of the Philippines prior to the outbreak, we confirm that remittances are associated with financial inclusion, particularly for women. We discuss the potential impacts of the pandemic on financial inclusion through the change in the flow of remittances. We show that a substantial decline in remittances caused by the COVID-19 crisis may have an adverse effect on financial inclusion in the Philippines.

JEL classification: F22. F24, F36, G21, O16
Keywords: financial inclusion, SDGs, COVID-19, remittance, migration, Philippines

1. Introduction

Financial inclusion that promotes access to and use of the formal financial services that are available to any individual is an essential element in improving economic opportunity and security, which is particularly beneficial to women and impoverished adults [Demirgüç-Kunt et al. 2017]. This issue has gained importance particularly in developing countries and is well acknowledged by both academics and policymakers. In fact, the Sustainable Development Goals (SDGs) aim to "[s]trengthen the capacity of domestic financial institutions to encourage and expand access to banking, insurance, and financial services for all".[1] However, the current state of access to financial services remains disappointing. While on

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[1] The target is stated in Target 8.10. The United Nations Capital Development Fund (UNCDF) states that financial inclusion also supports eight out of the seventeen Sustainable Development Goals (https://www.uncdf.org/financial-inclusion-and-the-sdgs). Also see Klapper et.al [2016].

average, financial inclusion progressed from 51 percent to 69 percent between 2011 and 2017 in terms of the proportion of the "banked" who hold an account at a financial institution or with a mobile money provider, approximately 1.7 million adults worldwide remained "unbanked" [Global Findex Report 2017][2]. In 2017, the proportion of the "unbanked" was disproportionally higher at 63 percent in low- and middle-income countries with a wide variation across countries and individuals. This is in contrast to the virtually universal possession in high-income countries (94 percent).

Financial inclusion promotes the availability of a variety of financial products such as payment services, savings accounts, loans, and insurance for individuals, and benefits them by mitigating poverty through consumption smoothing, productive investment, and financial risk management (Karlan et al. [2016]; Demirgüç-Kunt et al. [2017]). To expand financial inclusion, governments can take initiatives in developing financial markets, specifically by switching from cash to digital payments for wages and pensions. Furthermore, recent literature has underscored the role of remittances in promoting financial inclusion; remittances may have a positive impact on financial inclusion by increasing the demand for saving instruments as a means of storing excess cash or they may make loan conditions more relaxed by serving as collateral. Moreover, those transactions may further mitigate asymmetry in the information available to financial institutions and enhance financial knowledge within households (Anzoategui et al. [2014]; Aga and Martínez Pería [2014]). The movement in this direction is also reinforced by the fact that remittance inflow to low- and middle-income countries has been growing steadily over three decades to reach an estimated 714 trillion US dollars in 2019, which surpassed both Official Development Assistance (ODA) and Foreign Direct Investment (FDI) [World Bank 2020b].

The outbreak of the COVID-19 pandemic is a serious concern due to the negative impact it will have on financial inclusion by reversing the expanding trend of remittance inflows. As 80 percent of the world's total remittances flowed to low- and middle-income countries in 2019, the pandemic is expected to substantially reduce the remittances that migrants from developing countries can send home [World Bank 2020b]. The World Bank reports that remittances to low- and middle-income countries are likely to fall by 19.7 percent in 2020 (a 13 percent decline in East Asia and the Pacific region), which would be the sharpest global decline in recent history.[3] According to the central bank of the Philippines, the inflow of remittances sent by overseas Filipino's started to decline from March 2020.[4] In response, the Philippine Government began to release 200 US dollars as cash relief to distressed overseas Filipino workers (OFW).[5] Indeed, severe economic downturns in destination countries under a lockdown or due to

[2] Demirgüç-Kunt et al. [2018].
[3] World Bank [2020c].
[4] Bangko Sentral ng Pilipinas [n.d.].
[5] Cash relief is delivered to the affected migrants and their families in Davao del Sur under the initiative of Overseas Workers Welfare Administration (OWWA).

oil price crashes are reducing job opportunities and lowering wages for migrants [IOM 2020]. Even if migrants retain jobs in their host countries, they may find it difficult to send their remittances back home where there are severe restrictions on movement and tight regulations on money transfer services [World Bank 2020a]. Moreover, many migrants who had prepared themselves for impending migration were forced to stay in their home countries, with some discouraged from migrating entirely and forced to change their livelihood.

This paper examines the relationship between remittance and financial inclusion and discusses the potential impacts of the COVID-19 pandemic on household financial inclusion in the Philippines—a country that is heavily dependent on remittances. The Philippines is one of the largest source countries for migrants and one of the most remittance-dependent countries in the world [Yang 2011]. The number of overseas Filipino workers was estimated at 2.2 million in 2016 and the remittance inflow to the Philippines was 35,167 million US dollars in 2019, which ranked the country fourth in the world for remittance inflow [World Bank 2020b].[6] The proportion of remittances relative to the GDP of the Philippines was high at 9.9 percent. Moreover, some of the destination countries accepting Filipino migrants are those most seriously damaged by lockdowns and oil price crashes during the COVID-19 pandemic. In 2016, the top destinations for Filipino migrant workers included Saudi Arabia, the United Arab Emirates, Kuwait, Qatar, Hong Kong, and Singapore, which combined accounted for two-thirds of the total destinations [Philippine Statistics Authority 2017].[7] Furthermore, the Philippines holds a unique position in the trend of financial inclusion in terms of gender inequality; the proportion of the "unbanked" is smaller for women than men by more than 10 percentage points [Global Findex Report 2017]. Therefore, it is important to examine the relationship between remittances and women's financial inclusion and the potential impact of the COVID-19 pandemic on their financial inclusion.

In this paper, we utilize a household-level dataset that was collected in two rural municipalities in the Philippines. One of the advantages of using household-level data is that it addresses heterogeneity in household characteristics and the diversity of migrant destinations among Filipino migrants. We first pin down the empirical relationship between remittance income and financial inclusion by two-stage least squares (2SLS) instrumenting remittance income by macroeconomic variables exogenous to households. We then discuss the potential impacts of the pandemic on financial inclusion through the change in the flow of remittances using the revision of the 2020 GDP forecasts by the International Monetary Fund (IMF) and the World Bank, which were made before and after the outbreak of the COVID-19 pandemic. We show that a substantial decline in remittances due to the COVID-19 crisis may have an adverse effect on financial inclusion in the Philippines.

[6] The amount of remittance inflow in 2019 was the largest in India (83,131 million US dollars, 2.8 percent of GDP), followed by China (68,398 million US dollars, 0.5 percent of GDP) and Mexico (38,520 million US dollars, 3.0 percent of GDP).

[7] The Stock Estimate of Overseas Filipinos (Commission on Filipinos Overseas 2013) shows that the top five destination countries were the U.S., followed by Saudi Arabia, the UAE, Malaysia and Canada.

This paper proceeds as follows: Section 2 provides a brief survey of the literature on remittances and financial inclusion. Section 3 then describes the dataset used in this study. Section 4 investigates the relationship between remittance income and financial inclusion through macroeconomic variables before the COVID-19 outbreak. Section 5 discusses the impact of the pandemic on household financial inclusion and Section 6 presents the conclusions.

2. Previous literature

There has been a large volume of literature on remittances and their impact on development [Neceur et al. 2020].[8] In this section, we confine the literature survey to remittances and financial inclusion using household-level data, while we acknowledge that the relationship between remittances and financial inclusion has also been extensively examined using cross-country data.[9]

To our knowledge, the literature on remittances and financial inclusion using household-level data is relatively new. One of the early papers is Anzoategui et al. [2014] which examined the relationship between remittances and financial inclusion using household-level data in El Salvador. Employing instrumental variable estimation, they found that remittances have a positive impact on financial inclusion in terms of the use of deposit accounts but do not have a significant effect on demand or use of formal credits. They discussed the fact that the obscure impact on credits is attributed to two opposite forces; remittance serves as collateral for financial institutions to provide credit while remittances relax the credit constraints on households.[10] Aga and Martínez Pería [2014] also found that remittances enhance the probability of a household opening up a bank account in five Sub-Saharan African countries, which is confirmed by employing a two-stage least squares (2SLS) estimation using the macroeconomic performance of the destination countries as an instrumental variable. Moreover, Ambrosius and Cuecuecha [2016] examined the effect of remittances on the use of financial services both formal and informal, and found that remittances have a positive impact on the ownership of savings accounts; this has been repeatedly confirmed in subsequent papers.[11] The authors also found that remittances do not facilitate the taking on of loans from formal financial institutions but rather from informal sources, implying that remittances are not necessarily a substitute for but rather a complement to lending through undeveloped bank loans.

[8] There is a large body of literature on the impact that remittances have on development, which covers economic growth, poverty, education, labor supply, health and entrepreneurship. There is also a large volume of work on remittances and financial development (financial depth), which is different but close to financial inclusion, that uses macro-level data to shows that remittances are likely to encourage financial development [Demirguc-Kunt et al. 2016].

[9] Empirical papers using cross-country data include Aggarwal et al. [2011], Inoue and Hamori [2016], Tu et al. [2019], and Neceur et al. [2020].

[10] Substitution between remittances and receiving credit is further examined by Ambrosius and Cuecuecha [2013] who claimed that remittances are financing household emergencies and are less dependent on debt financing in response to negative health events.

[11] An exception is Brown et. al. [2013] which showed that remittances have either a negative or little effect on the propensity of individuals to have a bank account in Azerbaijan and a positive but small effect in Kyrgyzstan.

Overall, there is a consensus among the various papers on financial inclusion using household-level data that remittances have a positive impact on the propensity of individuals to hold a savings account, while empirical results are mixed on the impact of remittances on credits/loans.[12]

3. Data description

The dataset used in this study is the "Survey on Remittances and Household Finances in the Philippines,"[13] conducted by the Japan International Cooperation Agency (JICA) in two municipalities in the country: Dingras, Ilocos Norte located in the Northern Luzon Island, and Bansalan, Davao del Sur located in the southern island of Mindanao.[14] The sample size at the first-round was 200 overseas migrant households and 200 non-overseas migrant households in each municipality, which were randomly selected in each area. In the survey, a migrant household is defined as a household that has at least one member who permanently resides at the house but was working or living overseas at the time of data collection. Migrant households were oversampled to make up 50 percent of the total sample, although the stock of overseas Filipino workers was one-tenth of the total population [Commission on Filipinos Overseas 2013]. The barangays served as strata for stratified random sampling in each municipality and the sample households were randomly selected within each barangay.[15] The sample of 200 overseas migrant households was proportionately distributed among the barangays. Once the number of overseas migrant households in a barangay was determined, an equal number of non-overseas migrant households was randomly selected within each barangay. The sample is statistically representative of each municipality.

The questionnaire covered information on household roster, household spending/budgets/assets, remittance-receiving behaviors, and financial inclusion, such as the type of financial accounts that are held by the household members and the methods of financial transactions used, as well as household savings and loans. The eligible respondents were the primary financial decision-makers in each household. The first-round survey was conducted in August and September 2016 in 31 barangays in Dingras and 25 in Bansalan. The sample size for the first round was 834. The second-round survey was implemented in June-August 2017.

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[12] Not using household-data but municipality-level data, Demirgüç-Kunt et al. [2011] showed that remittances are associated with the breadth and depth of the banking sector, i.e., an increase in the number of branches and accounts per capita and the deposits to GDP.

[13] The description of the dataset depends on Murakami et al. [2020]. The field survey was conducted by Orient Integrated Development Consultants Incorporated (OIDCI). Yamada et al. [2019] used the data to analyze the gender gap in financial inclusion in the Philippines and Murakami et al. [2020] used the data to analyze the effects of the Covid-19 pandemic on household welfare.

[14] These municipalities were selected in order to oversample households with overseas migrants. The listing required cooperation from local administrative authorities and public service providers, who keep information on who in the barangay currently resides overseas.

[15] The barangay is an administrative unit and a subdivision of a city or municipality in the Philippines.

The sample size in the second round was 668. The attrition rate was 19.9 percent (16.6 percent in Bansalan and 23.2 percent in Dingras).[16]

Figure 1 illustrates household financial inclusion in the survey. We compare financial inclusion between households receiving remittances and those not receiving remittances. Panel (1) measures financial inclusion in terms of the proportion of households where at least one member holds or uses any or each of the types of financial accounts (bank, cooperative, or microfinance) and has availed themselves of loans (formal, family, or informal). Formal loans include loans from banks, cooperatives, and microfinance loans, as well as state-owned insurance/loan services such as the Government Service Insurance System (GSIS), the Social Security System (SSS), and the Pag-IBIG Fund (Home Development Mutual Fund).[17] Family loans refer to those from family members and relatives, and informal loans include those from local pawnshops, the "5-6" lending scheme,[18] and the Paluwagan (group saving) scheme. We call this measure "household financial inclusion." The proportion of households with any form of financial accounts is 67 percent for households with remittances, which is higher than those without remittances (54 percent). This is also the case for actively using any financial accounts, which sits at 65 percent for households that receive remittances and 53 percent for households that do not receive remittances. Taking a closer look, the proportion of households having/using an account differs between the types of financial institutions. Households with remittances represent a larger proportion of those who have/use a bank account than households that do not receive remittances. The proportion of households that have/use a bank account is 28 percent (27 percent for using it) for remittance-receiving households, which is three times higher than that for non-remittance-receiving households; this is likely because the commission fee that must be paid when receiving remittances is typically lower when the remittance is received through a bank account.[19] In contrast, the proportion of households that hold/use a cooperative account is higher for households without remittances. The proportion of households that hold/use a microfinance account is higher for households with remittances, which is the same situation as with bank accounts, but the gap is smaller. The gap in the proportion of households availing themselves of loans is smaller than that of

[16] In the first-round survey, 32.3 percent of the households in Dingras had at least one migrant and the proportion is much smaller in Bansalan, accounting for only 2.8 percent (10.6 percent of the total samples of two municipalities). According to 2018 National Migration Survey, 8.9 percent of the households in Ilocos Region (where Dingras belongs) had at least one OFW (Overseas Filipino Workers) in the past 12 months. It was 5.7 percent for the Davao where Bansalan is located (6.4 percent nationwide). The average proportion of income from remittance for households with migrants was 43.2 percent in Dingras and 50.2 percent in Bansalan at the first-round survey. Therefore, our data covers the regions both more and less heavily depending on migration and remittances.

[17] The beneficiaries of GSIS are the government employees. SSS is the state-owned insurance system for general citizens. The Pag-IBIG Fund provides short-term loans and housing programs run by the government.

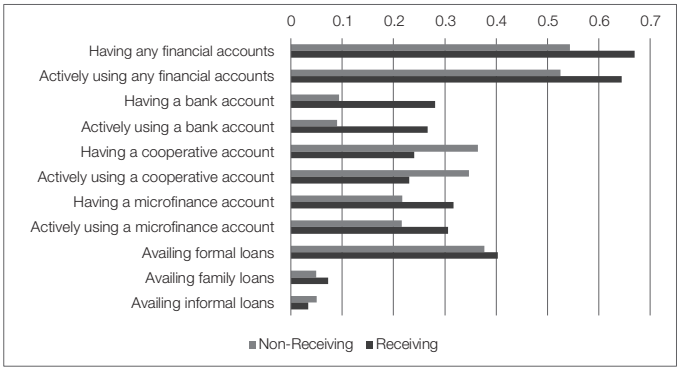
[18] The "5-6" lending scheme is a popular informal finance scheme typically exercised by Indian lenders in the Philippines. It is called 5-6 because they are said to charge 20 percent interest per month.

[19] World Bank [2020d].

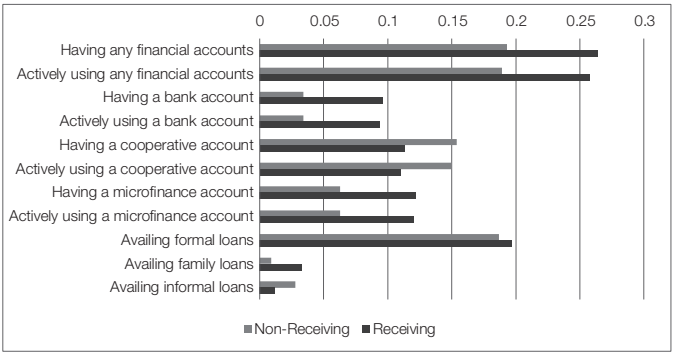
financial accounts. The proportion of households using formal or family loans is slightly higher for households with remittances but the proportion of households availing themselves of informal loans is slightly higher for households without remittances.

FIGURE 1. Financial inclusion in households with and without remittances

1. Household financial inclusion



2. Women's financial inclusion



Note: Authors' calculation. Panel (1) shows proportions of households where at least one member holds or uses any or each of financial account types (bank, cooperative, or microfinance) and which avails itself of loans (formal, family, and informal). Panel (2) shows the same proportions of households whose at least one female member holds or uses any or each financial account and which avails loans.

Panel (2) illustrates the same proportion of households where at least one of the women holds or uses a financial account and/or has taken out a loan. This definition is called "women's financial inclusion." Here we see the same pattern as observed in Panel (1). The proportion of having/using any financial accounts is higher for households with remittances, which is also the case for bank or microfinance accounts; however, the proportion is lower for cooperative accounts. The gap in the proportion of households availing themselves of loans is small. This gap is slightly higher in relation to formal and family loans and is slightly lower in relation to informal loans for households with remittances.

In sum, a simple comparison of averages shows that (with the exception of cooperative accounts) remittance-receiving households are more financially included than households that do not receive remittances. When looking at having/using a bank account where the commission fee for receiving remittances is low, the difference is pronounced. However, we cannot immediately conclude that remittances promote financial inclusion as we must first address any endogeneity issues, such as reverse causality and any third factor affecting both remittances and financial inclusion. Therefore, we must first perform estimation correcting endogeneity to explore whether remittances indeed promote financial inclusion or not.

Table 1 shows the summary statistics of the variables used in the estimation.[20] Here we use the data from the households that were surveyed during both the first and second rounds. In the case of household financial inclusion, the average number of households having or actively using any financial accounts is more than 50 percent. By type of financial institution, the average proportion is higher for a microfinance account at close to 30 percent, followed by a cooperative account, and having or using a bank account is smaller at close to 20 percent. With regard to women's financial inclusion, the average number of women who hold or use any financial accounts is close to 20 percent. By type of financial institutions, we note that the highest proportion is found in a cooperative account and the proportion is on par with that of bank accounts and microfinance accounts. The proportion of households using loans is the highest in formal loans and that to use family loans or informal loans is small. This pattern is also observed in relation to women's financial inclusion. As will be explained in the next section, "Destination per capita GDP (*ECON*)" refers to the weighted average of per capita Gross Domestic Product (GDP) for all destination countries and the Philippines. The remaining variables are related to remittances and household characteristics. Half of all households receive remittances, which stems from our sampling design, and the average monthly remittances per capita is 30.1 pesos.[21] Turning to household characteristics, the average age of the head of households is 52 years old and the household size including overseas members is close to five people. More than half of all heads of households had attained secondary education or higher. The share of non-agricultural occupation is less than 20 percent.[22] The remaining variables capture any adverse shocks to households.[23] Approximately, 18 percent of all households experienced unemployment or business failure, and 16 percent of households suffered as a result of illness, accidents, or disasters. More than 20 percent of all households suffered from crop failure and 10 percent experienced family separation.

[20] At the first around survey, we see that per capita expenditure is systematically larger and the ages of the heads of household are higher for the attrition households. Thus, households in the sample cover the lower side of income distribution in the two village economies.

[21] The mean covers all sample households including non-receiving ones.

[22] Seamen occupy a large part of the migrant job market in the Philippines but our sample contains very few of those migrants.

[23] These reported shocks happened in the year prior to the 1st round survey and after the 1st round survey for the 2nd round.

TABLE 1. Summary statistics

Variables	(1) N	(2) Mean	(3) S.d	(4) Min	(5) Max
Household financial inclusion					
Having any financial accounts	1,296	0.566	0.496	0	1
Actively using financial accounts	1,296	0.544	0.498	0	1
Having a bank account	1,296	0.193	0.395	0	1
Actively using a bank account	1,296	0.181	0.385	0	1
Having a cooperative account	1,296	0.251	0.434	0	1
Actively using a cooperative account	1,296	0.230	0.421	0	1
Having a microfinance account	1,296	0.292	0.455	0	1
Actively using a microfinance account	1,296	0.288	0.453	0	1
Financial inclusion of Women					
Having any financial accounts	1,265	0.196	0.397	0	1
Actively using any financial account	1,265	0.191	0.393	0	1
Having a bank account	1,265	0.081	0.272	0	1
Actively using a bank account	1,265	0.078	0.269	0	1
Having a cooperative account	1,265	0.101	0.302	0	1
Actively using a cooperative account	1,265	0.094	0.292	0	1
Having a microfinance account	1,265	0.084	0.277	0	1
Actively using a microfinance account	1,265	0.084	0.277	0	1
Household loans					
Formal loans	1,296	0.343	0.475	0	1
Family loans	1,296	0.070	0.256	0	1
Informal loans	1,296	0.034	0.181	0	1
Loans to women					
Formal loans	1,265	0.146	0.353	0	1
Family loans	1,265	0.022	0.147	0	1
Informal loans	1,265	0.009	0.0970	0	1
Destination per capita GDP*	1,296	8.571	0.792	7.917	10.61
Receive Remittances (dummy)	1,296	0.519	0.500	0	1
Remittance Income (log)	1,296	3.558	3.563	0	10.82
Head's age	1,296	51.73	13.85	20	95
Square of head's age	1,296	2,867	1,474	400	9,025
HH size including overseas members	1,296	4.945	2.143	1	15
Secondary or above education	1,296	0.584	0.493	0	1
Non-agricultural Occupation	1,296	0.184	0.387	0	1
Unemployment and business failure	1,296	0.184	0.388	0	1
Illness, accident, and disasters	1,296	0.168	0.374	0	1
Crop failure	1,296	0.215	0.411	0	1
Family Separation	1,296	0.125	0.331	0	1

Note: Authors' calculation.
* refers to a weighted average of all destinations including the Philippines in logarithm.

4. Empirical analysis

Using the data explained in the previous section, we empirically examine the impact of overseas remittances on household financial inclusion. We are interested in estimating:

$$FL_{it} = \beta_0 + \beta(REMITTANCE_{it}) + \gamma \mathbf{x}_{it} + barangay_i + \lambda_t + \varepsilon_{it} \qquad (1)$$

where i indexes households and t refers to the survey round with 0 indicating 2016 and 1 indicating 2017. The dependent variables FL_{it} consist of three groups. The first group considers household financial inclusion and consists of the binary variables of having or using any financial accounts and having or using each type of financial account (bank, cooperative, or microfinance). FL_{it} takes one if any household members have or use financial accounts and 0 for if no household members have or use financial accounts. The second group contains the same indicators for women's financial inclusion. FL_{it} takes one if any female household members have or use financial accounts and 0 for if no female household members have or use financial accounts. The third group has binary variables to indicate households with at least one member who uses loans according to type (formal, family or informal) and those variables for households with at least one female member who avails herself of loans.

The main explanatory variable $REMITTANCE_{it}$ takes two forms: an indicator for households who receive remittances, or do not, and the log of average monthly income from overseas remittance per capita. Both variables are computed using the information on the average monthly income either over the past 12 months for the first round or the period since the first-round visit in the case of the second round.[24] $\mathbf{x}$ is a vector of household characteristics that includes the age of the household head, household size, the educational attainment level of the household head, their occupation and a variety of adverse shocks to the household; these figures are shown in Table 1. We also include barangay fixed effect ($barangay_i$) and survey round fixed effect (λ_t). Lastly, ε_{it} is an i.i.d. error term.

There is a concern about the endogeneity issue since financial inclusion is likely to be affected by remittances and vice versa. It is well known that addressing endogeneity is one of the most crucial elements of estimation relating to remittances and the effects [McKenzie et al. 2010]. In the context of the Philippines, individuals with high endowments hold a higher ability to earn and they are more likely to migrate abroad and, at the same time, to have bank accounts for their financial transactions. If this is the case, an OLS estimate will produce biased coefficients.

[24] Since the interval between the two round surveys is less than one year, we use the value of the monthly average since the first-round visit. The qualitative results are not changed if we use the average over the past 12 months for the second round.

In order to correct the endogeneity of remittances in relation to financial inclusion, we employ a two-stage least squares (2SLS) estimation using an index of the macroeconomic performance of the destination countries and the Philippines as an instrumental variable (IV) for remittances.[25] We assume that the macroeconomic conditions affect remittances but do not directly affect the financial inclusion of households in the Philippines. We assume that GDP per capita is exogenous to the number of remittances in each household, meaning that the variable picks up supply-side shocks on migrants' remittances, which reflects labor market conditions that they are exposed to in the destination countries.

We construct the economic performance (*ECON*) variable, the index of the macroeconomic performance in the destination and home countries, by taking the weighted average per capita GDP of the country of residence of each household member including overseas migrants. More specifically, the *ECON* variable is defined as:

$$ECON_{it} = \mathrm{In}\frac{\Sigma_{k\in\kappa(i)} g_{kt} \times n_{kit}}{\Sigma_{k\in\kappa(i)} n_{kit}}$$

Here, $k(i)$ refers to the set of countries where the adult members of a household i live, g_{kt} is the log GDP per capita in country k in t (2016 or 2017), and n_{kit} is the number of household i's adult members who live in the country k. Thus, by construction, we use per capita GDP in the Philippines for households without migrants. We acknowledge that there are threats to exclusion restrictions for this instrument. For example, it is possible that high-endowment migrants are also likely to choose a high-income destination country. It is also possible that changes in economic performance outside the Philippines will have a direct effect on the financial transactions in the Philippines not through remittances but trade and financial channels affecting wage and employment prospects. We note these threats can cause estimation bias for the impact of remittances on financial inclusion. However, given the diversity of destination countries by Filipino migrants, we use this instrumental variable because per capita GDPs are widely available statistics across countries and years.[26, 27]

[25] Ratha and Shaw [2007] used weighted value of destination GDP in cross-country estimating remittances inflow. Yang [2008] instead used the appreciation of the Philippine peso during the 1997 Asian financial crisis as an exogenous shock to international remittances.

[26] Overestimation bias is likely if households with unobserved high endowment are more likely to be financially included. Underestimation bias is likely if the change in destination's GDP tends to be positively correlated with the change in the Philippines GDP. In this case, the Philippines GDP will affect more profoundly the economic situation of non-remittance receiving households whose breadwinner works in domestic labor market.

[27] In our sample, the destination of migrants is diversified across 33 countries and seaman. The top 10 destinations are; Saudi Arabia (18.5 percent), Kuwait (11.2 percent), UAE (9.7 percent), Hawaii (8.5 percent), Hong Kong (6.4 percent), Canada (5.8 percent), Singapore (5.2 percent), Japan (5.2 percent), Qatar (3.6 percent), and the USA (3.6 percent).

In the estimation, we pool the observations for all households (two observations for each household). While the dataset is longitudinal, the interval is short (less than one year) and we see little change in the remittances during the survey period. Thus, we use a level specification by pooling the observations at the first and second rounds, rather than a difference specification where it is difficult to obtain stable estimation results.

We estimate specification (1) using 2SLS with instrumenting $REMITTANCE_{ii}$ by $ECON_{it}$. The first stage equation is explicitly given as:

$$REMITTANCE_{it} = \eta_0 + \eta\left(ECON_{it}\right) + \delta \mathbf{x}_{it} + barangay_i + \mu_t + v_{it} \qquad (2)$$

where the notations are the same as in equation (1) except for the main explanatory variable *ECON* explained above. We apply a linear specification both for the first stage and the second stage equations to estimate the coefficients at the first and second stages in a single estimation procedure.

Column (1) of Table 2 shows that the coefficient on *ECON* is positive and significant at the first stage regression when the dependent variable is a dummy for households to receive any remittances indicating that the variable serves as a valid instrument. We performed a weak IV test and confirmed that *F*-test statistic for weak IV is 732.1 with p value of 0.00. The remaining columns of Table 2 (1) report the coefficients at the second stage regression for household financial inclusion. The coefficients on remittances are positive but not statistically significant in Column (1) and (2) but they are positive and significant for having/using a bank account, showing that households receiving remittances are 20 percent more likely to have or use a bank account than households that do not receive remittances. Those coefficients are not significant for having/using a cooperative account (Columns (5) and (6)) nor for having/using a microfinance account (Columns (7) and (8)). Table 2 (2) shows the results for women's financial inclusion. The positive and significant coefficients on remittance in Column (1) and (2) implies that households with remittances are more likely to have or use any financial accounts than households without remittances. The coefficients on remittances are positive and significant for having/using a bank account (Columns (3) and (4)) or a microfinance account (Columns (7) and (8)). Table 2 (3) reports that the coefficients in the case of loans are not significant in all columns except informal loans to women's financial inclusion; remittance is negatively associated with informal loans in the case.

TABLE 2. Estimation results (2SLS; Dummy for remittances)
1. Household financial inclusion

	First Stage	Second Stage							
VARIABLES	Receive remittances (dummy)	(1) Having any financial accounts	(2) Using any financial accounts	(3) Having a bank account	(4) Using a bank account	(5) Having a cooperative account	(6) Using a cooperative account	(7) Having a microfinance account	(8) Using a microfinance account
Destination per capita GDP	0.431***								
	(0.0169)								
Receive remittances (dummy)		0.0896	0.0569	0.224***	0.213***	0.0323	0.00413	-0.0317	-0.0326
		(0.0644)	(0.0624)	(0.0533)	(0.0519)	(0.0450)	(0.0415)	(0.0595)	(0.0592)
Head's age	-0.0177***	0.0347*	0.0342*	0.00362	0.00447	0.0348*	0.0318*	0.0168	0.0181
	(0.00664)	(0.0185)	(0.0177)	(0.00915)	(0.00890)	(0.0187)	(0.0184)	(0.0114)	(0.0111)
Square of head's age	0.000194***	-0.000388**	-0.000364**	-3.16e-05	-3.82e-05	-0.000370**	-0.000323*	-0.000173*	-0.000184*
	(6.28e-05)	(0.000174)	(0.000165)	(8.46e-05)	(8.17e-05)	(0.000174)	(0.000169)	(0.000105)	(0.000103)
HH size including overseas members	0.00718	-0.00461	0.00563	-0.0134	-0.0133	-0.00654	0.00392	0.0156	0.0150
	(0.00635)	(0.0166)	(0.0162)	(0.0101)	(0.00976)	(0.0148)	(0.0142)	(0.0132)	(0.0131)
Secondary or above education	0.0632**	0.0841	0.107*	0.113***	0.116***	-0.0178	-0.00511	-0.0545	-0.0496
	(0.0320)	(0.0585)	(0.0572)	(0.0372)	(0.0369)	(0.0515)	(0.0490)	(0.0737)	(0.0734)
Non-agricultural Occupation	0.0311	0.100	0.117*	0.0884**	0.0867**	0.00363	0.0108	0.0965	0.0999
	(0.0446)	(0.0619)	(0.0625)	(0.0393)	(0.0379)	(0.0638)	(0.0636)	(0.0957)	(0.0954)
Unemployment and business failure	-0.0238	-0.184**	-0.198***	-0.0813	-0.0721	-0.130*	-0.151*	0.00288	0.00958
	(0.0321)	(0.0716)	(0.0725)	(0.0507)	(0.0499)	(0.0789)	(0.0806)	(0.0531)	(0.0522)
Illness, accidents, and disasters	0.0692	0.00276	0.0163	-0.0832*	-0.0822*	-0.0457	-0.0349	0.0897	0.0933
	(0.0567)	(0.0676)	(0.0712)	(0.0427)	(0.0424)	(0.0758)	(0.0787)	(0.0720)	(0.0713)
Crop failure	-0.00419	0.137**	0.131**	-0.0784*	-0.0765*	0.0871	0.0834	0.0390	0.0402
	(0.0217)	(0.0561)	(0.0583)	(0.0447)	(0.0448)	(0.0607)	(0.0628)	(0.0796)	(0.0790)
Family separation	-0.0267	0.158**	0.108	0.00423	0.00211	0.157*	0.106	-0.0205	-0.0195
	(0.0354)	(0.0772)	(0.0840)	(0.0339)	(0.0334)	(0.0809)	(0.0895)	(0.0544)	(0.0541)
Constant	-2.913***	-0.478	-0.568	0.0666	0.0394	-0.720	-0.733	-0.134	-0.176
	(0.269)	(0.465)	(0.450)	(0.263)	(0.259)	(0.460)	(0.458)	(0.300)	(0.293)
Observations	1,296	1,296	1,296	1,296	1,296	1,296	1,296	1,296	1,296
R-squared	0.503	0.328	0.320	0.196	0.190	0.409	0.394	0.248	0.251

Note: Cluster-robust standard errors at the household level in parentheses.*** $p<0.01$, ** $p<0.05$, * $p<0.1$. *F*-test statistic for weak IV is 732.11 with p-value of 0.00.

TABLE 2. Estimation results (2SLS; Dummy for remittances) continued
2. Women's financial inclusion

	First Stage	Second Stage							
VARIABLES	Receive remittances (dummy)	(1) Having any financial accounts	(2) Using any financial accounts	(3) Having a bank account	(4) Using a bank account	(5) Having a cooperative account	(6) Using a cooperative account	(7) Having a microfinance account	(8) Using a microfinance account
Destination per capita GDP	0.435***								
	(0.0172)								
Receive remittances (dummy)		0.106**	0.104**	0.0847**	0.0814**	-0.00507	-0.00911	0.0923**	0.0923**
		(0.0489)	(0.0488)	(0.0332)	(0.0330)	(0.0245)	(0.0240)	(0.0402)	(0.0402)
Head's age	-0.0172**	0.00110	0.000506	-0.00133	-0.000525	0.00348	0.00165	0.00764	0.00764
	(0.00683)	(0.0153)	(0.0151)	(0.00347)	(0.00318)	(0.0144)	(0.0143)	(0.00738)	(0.00738)
Square of head's age	0.000191***	8.69e-06	1.46e-05	1.98e-05	1.12e-05	-2.36e-05	-4.67e-06	-6.83e-05	-6.83e-05
	(6.42e-05)	(0.000140)	(0.000139)	(3.46e-05)	(3.13e-05)	(0.000132)	(0.000131)	(7.00e-05)	(7.00e-05)
HH size including overseas members	0.00641	0.00943	0.0101	0.00349	0.00270	0.00914	0.0107	0.000635	0.000635
	(0.00677)	(0.0123)	(0.0122)	(0.00538)	(0.00531)	(0.00916)	(0.00908)	(0.00850)	(0.00850)
Secondary or above education	0.0662*	0.0130	0.00962	0.0269*	0.0286*	-0.00652	-0.0101	-0.0662	-0.0662
	(0.0347)	(0.0573)	(0.0569)	(0.0154)	(0.0154)	(0.0552)	(0.0547)	(0.0496)	(0.0496)
Non-agricultural Occupation	0.0291	0.217**	0.221**	0.00934	0.00930	0.179**	0.184**	0.116	0.116
	(0.0464)	(0.0979)	(0.0975)	(0.0151)	(0.0149)	(0.0839)	(0.0837)	(0.0900)	(0.0900)
Unemployment and business failure	-0.0203	-0.0771	-0.0742	0.0316	0.0326	-0.155**	-0.153**	0.0151	0.0151
	(0.0345)	(0.0683)	(0.0683)	(0.0214)	(0.0214)	(0.0626)	(0.0629)	(0.0466)	(0.0466)
Illness, accidents, and disasters	0.0690	-0.0661	-0.0575	-0.00432	-0.00302	-0.130**	-0.119*	0.0445	0.0445
	(0.0595)	(0.0627)	(0.0620)	(0.0133)	(0.0131)	(0.0613)	(0.0616)	(0.0429)	(0.0429)
Crop failure	-0.00366	0.0792	0.0833	0.000550	0.00161	0.00877	0.0129	0.0110	0.0110
	(0.0231)	(0.0787)	(0.0779)	(0.0158)	(0.0160)	(0.0706)	(0.0701)	(0.0662)	(0.0662)
Family separation	-0.0256	0.130	0.135	-0.00359	-0.00426	0.155**	0.163**	-0.0687*	-0.0687*
	(0.0357)	(0.0847)	(0.0836)	(0.0111)	(0.0111)	(0.0788)	(0.0776)	(0.0416)	(0.0416)
Constant	-2.955***	-0.0644	-0.0536	0.0800	0.0672	-0.197	-0.163	-0.0480	-0.0480
	(0.274)	(0.407)	(0.405)	(0.152)	(0.149)	(0.377)	(0.375)	(0.216)	(0.216)
Observations	1,265	1,265	1,265	1,265	1,265	1,265	1,265	1,265	1,265
R-squared	0.502	0.256	0.264	0.120	0.117	0.321	0.332	0.149	0.149

Note: Cluster-robust standard errors at the household level in parentheses.*** $p<0.01$, ** $p<0.05$, * $p<0.1$. *F*-test statistic for weak IV is 732.11 with p-value of 0.00.

TABLE 2. Estimation results (2SLS; Dummy for remittances) continued

3. Loans

	Second Stage					
Variables	**(1) Availing family loans**	**(2 Availing formal loans**	**(3) Availing informal loans**	**(4) Availing family loans (female)**	**(5) Availing formal loans (female)**	**(6) Availing informal loans (female)**
Receive remittances (dummy)	-0.0248	-0.00593	-0.0133	-0.00542	-0.00125	-0.0177*
	(0.0575)	(0.0291)	(0.0192)	(0.0420)	(0.0174)	(0.0103)
Head's age	0.0328**	0.000520	0.000425	0.0139	-0.00224	-0.00172*
	(0.0154)	(0.00265)	(0.00282)	(0.0145)	(0.00203)	(0.000998)
Square of head's age	-0.000373**	-5.53e-06	1.99e-06	-0.000120	2.62e-05	2.08e-05*
	(0.000145)	(2.75e-05)	(3.14e-05)	(0.000135)	(2.14e-05)	(1.23e-05)
HH size including overseas members	0.0152	-0.00387	0.00170	0.0242*	-0.00110	0.00167
	(0.0154)	(0.00306)	(0.00345)	(0.0146)	(0.00189)	(0.00102)
Secondary or above education	0.00474	-0.0104	-0.00676	0.0221	-0.00464	0.00103
	(0.0532)	(0.0144)	(0.0208)	(0.0527)	(0.00814)	(0.00534)
Non-agricultural Occupation	0.0772	-0.00453	-0.0142	0.158	-0.000136	0.0120
	(0.0906)	(0.0117)	(0.0121)	(0.102)	(0.00630)	(0.00801)
Unemployment and business failure	-0.0364	0.0171	0.00618	-0.0626	0.00966	-0.000987
	(0.0727)	(0.0182)	(0.0172)	(0.0670)	(0.0158)	(0.00790)
Illness, accidents, and disasters	-0.0440	0.0245	0.0119	-0.0788	0.00695	-0.00293
	(0.0886)	(0.0181)	(0.0185)	(0.0651)	(0.0107)	(0.00334)
Crop failure	0.235***	0.0207	0.00808	0.0877	0.0171	3.65e-05
	(0.0762)	(0.0201)	(0.0149)	(0.0700)	(0.0179)	(0.00632)
Family separation	-0.0228	0.0279	0.00409	0.115	0.0306*	0.00755*
	(0.123)	(0.0204)	(0.0213)	(0.0920)	(0.0180)	(0.00433)
Constant	-0.565	0.223*	-0.0112	-0.437	0.166	0.0250
	(0.419)	(0.131)	(0.0586)	(0.395)	(0.111)	(0.0182)
Observations	1,296	1,296	1,296	1,265	1,265	1,265
R-squared	0.242	0.181	0.484	0.273	0.121	0.826

Note: Cluster-robust standard errors at the household level in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table 3 illustrates the results when the dependent variable is a logarithm of the number of remittances. The coefficient on *ECON* is positive and significant and indicates that the instrumental variable is valid. We performed a weak IV test and confirmed that F-test statistic for weak IV is 898.6 with p value of 0.00. The remaining columns show the coefficients at the second stage for household financial inclusion. The pattern of the coefficients is similar to those in Table 2. The coefficients are not significant in relation to having/using any financial accounts, a cooperative account, or a microfinance account; however, they are positive and significant for having/using a bank account. The coefficients imply that a one percent increase in the amount of remittance enhances the propensity of a household to have or use a bank account by 0.03 percent. Table 3 (2) shows the results for women's financial inclusion. The coefficient of remittance is 0.014 in Columns (1) and (2) implying that a one percent increase in the amount of remittances raises the probability of having or using a financial account by 0.01 percent. The coefficients pertaining to remittances are positive and significant for having/using a bank account or a microfinance account, and the size of the coefficients are comparable with those in Columns (1) and (2). Table 3 (3) shows that in the case of loans and remittances, the coefficients are not significant in all columns except informal loans to women's financial inclusion.

TABLE 3. Estimation results (2SLS; Amounts for remittances)
1. Household financial inclusion

	First Stage	Second Stage							
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	**Remittance income (log)**	**Having any financial accounts**	**Using any financial accounts**	**Having a bank account**	**Using a bank account**	**Having a cooperative account**	**Using a cooperative account**	**Having a microfinance account**	**Using a microfinance account**
Destination per capita GDP	3.301***								
	(0.117)								
Receive remittances (log)		0.0117	0.00743	0.0293***	0.0279***	0.00422	0.000540	-0.00414	-0.00425
		(0.00842)	(0.00815)	(0.00694)	(0.00675)	(0.00588)	(0.00542)	(0.00777)	(0.00772)
Head's age	-0.0658**	0.0339*	0.0337*	0.00158	0.00252	0.0345*	0.0318*	0.0171	0.0184*
	(0.0321)	(0.0185)	(0.0177)	(0.00937)	(0.00912)	(0.0187)	(0.0183)	(0.0113)	(0.0110)
Square of head's age	0.000813**	-0.000380**	-0.000359**	-1.18e-05	-1.94e-05	-0.000367**	-0.000323*	-0.000176*	-0.000187*
	(0.000318)	(0.000174)	(0.000164)	(8.62e-05)	(8.34e-05)	(0.000173)	(0.000168)	(0.000104)	(0.000102)
HH size including overseas members	0.0524	-0.00458	0.00565	-0.0133	-0.0132	-0.00653	0.00392	0.0156	0.0149
	(0.0347)	(0.0167)	(0.0163)	(0.0104)	(0.0101)	(0.0148)	(0.0142)	(0.0132)	(0.0131)
Secondary or above education	0.309	0.0861	0.108*	0.118***	0.120***	-0.0171	-0.00501	-0.0552	-0.0503
	(0.191)	(0.0586)	(0.0572)	(0.0380)	(0.0377)	(0.0514)	(0.0488)	(0.0734)	(0.0731)
Non-agricultural Occupation	-0.0170	0.103*	0.119*	0.0959**	0.0938**	0.00471	0.0110	0.0954	0.0988
	(0.170)	(0.0627)	(0.0630)	(0.0429)	(0.0415)	(0.0638)	(0.0637)	(0.0960)	(0.0957)
Unemployment and business failure	-0.0937	-0.185***	-0.199***	-0.0839*	-0.0745	-0.131*	-0.151*	0.00325	0.00996
	(0.190)	(0.0717)	(0.0725)	(0.0505)	(0.0496)	(0.0789)	(0.0805)	(0.0531)	(0.0521)
Illness, accidents, and disasters	0.349	0.00488	0.0177	-0.0779*	-0.0771*	-0.0449	-0.0348	0.0889	0.0925
	(0.252)	(0.0680)	(0.0714)	(0.0409)	(0.0407)	(0.0762)	(0.0788)	(0.0722)	(0.0715)
Crop failure	-0.0797	0.137**	0.132**	-0.0770*	-0.0752*	0.0873	0.0834	0.0388	0.0400
	(0.121)	(0.0561)	(0.0583)	(0.0443)	(0.0445)	(0.0608)	(0.0629)	(0.0796)	(0.0791)
Family separation	-0.0350	0.156**	0.107	-0.000734	-0.00263	0.156*	0.106	-0.0198	-0.0188
	(0.171)	(0.0774)	(0.0841)	(0.0343)	(0.0338)	(0.0808)	(0.0894)	(0.0544)	(0.0541)
Constant	-23.18***	-0.468	-0.561	0.0922	0.0638	-0.717	-0.732	-0.137	-0.179
	(1.773)	(0.468)	(0.451)	(0.267)	(0.263)	(0.460)	(0.457)	(0.298)	(0.291)
Observations	1,296	1,296	1,296	1,296	1,296	1,296	1,296	1,296	1,296
R-squared	0.584	0.325	0.319	0.198	0.191	0.409	0.394	0.248	0.252

Note: Cluster-robust standard errors at the household level in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$. *F*-test statistic for weak IV is 898.607 with p-value of 0.00.

TABLE 3. Estimation results (2SLS; Amounts for remittances) continued

2. Women's Financial Inclusion

	First Stage	Second Stage							
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	**Remittance income (log)**	**Having any financial accounts**	**Using any financial accounts**	**Having a bank account**	**Using a bank account**	**Having a cooperative account**	**Using a cooperative account**	**Having a microfinance account**	**Using a microfinance account**
Destination per capita GDP	3.322***								
	(0.119)								
Receive remittances (log)		0.0138**	0.0136**	0.0111**	0.0106**	-0.000663	-0.00119	0.0121**	0.0121**
		(0.00641)	(0.00640)	(0.00435)	(0.00432)	(0.00321)	(0.00314)	(0.00528)	(0.00528)
Head's age	-0.0610*	0.000123	-0.000455	-0.00212	-0.00128	0.00353	0.00173	0.00678	0.00678
	(0.0332)	(0.0152)	(0.0150)	(0.00337)	(0.00307)	(0.0144)	(0.0143)	(0.00734)	(0.00734)
Square of head's age	0.000772**	1.81e-05	2.39e-05	2.74e-05	1.85e-05	-2.41e-05	-5.49e-06	-6.01e-05	-6.01e-05
	(0.000326)	(0.000140)	(0.000138)	(3.36e-05)	(3.01e-05)	(0.000131)	(0.000130)	(6.95e-05)	(6.95e-05)
HH size including overseas members	0.0441	0.00950	0.0101	0.00355	0.00275	0.00913	0.0107	0.000694	0.000694
	(0.0374)	(0.0123)	(0.0123)	(0.00547)	(0.00539)	(0.00916)	(0.00907)	(0.00859)	(0.00859)
Secondary or above education	0.313	0.0156	0.0122	0.0291*	0.0306**	-0.00665	-0.0103	-0.0639	-0.0639
	(0.206)	(0.0574)	(0.0570)	(0.0152)	(0.0152)	(0.0550)	(0.0546)	(0.0498)	(0.0498)
Non-agricultural Occupation	-0.0370	0.221**	0.225**	0.0122	0.0121	0.178**	0.184**	0.119	0.119
	(0.177)	(0.0973)	(0.0970)	(0.0146)	(0.0145)	(0.0839)	(0.0836)	(0.0897)	(0.0897)
Unemployment and business failure	-0.0746	-0.0782	-0.0753	0.0307	0.0318	-0.155**	-0.153**	0.0141	0.0141
	(0.205)	(0.0683)	(0.0684)	(0.0214)	(0.0214)	(0.0626)	(0.0628)	(0.0466)	(0.0466)
Illness, accidents, and disasters	0.355	-0.0637	-0.0551	-0.00240	-0.00118	-0.130**	-0.120*	0.0466	0.0466
	(0.265)	(0.0618)	(0.0611)	(0.0126)	(0.0125)	(0.0615)	(0.0618)	(0.0425)	(0.0425)
Crop failure	-0.0838	0.0800	0.0841	0.00117	0.00221	0.00873	0.0128	0.0117	0.0117
	(0.127)	(0.0788)	(0.0780)	(0.0158)	(0.0159)	(0.0706)	(0.0701)	(0.0662)	(0.0662)
Family separation	-0.0201	0.127	0.133	-0.00554	-0.00613	0.155**	0.163**	-0.0708*	-0.0708*
	(0.174)	(0.0845)	(0.0834)	(0.0108)	(0.0108)	(0.0789)	(0.0777)	(0.0416)	(0.0416)
Constant	-23.44***	-0.0527	-0.0420	0.0894	0.0763	-0.197	-0.164	-0.0377	-0.0377
	(1.800)	(0.406)	(0.404)	(0.150)	(0.148)	(0.377)	(0.375)	(0.214)	(0.214)
Observations	1,265	1,265	1,265	1,265	1,265	1,265	1,265	1,265	1,265
R-squared	0.583	0.257	0.266	0.125	0.122	0.320	0.332	0.150	0.150

Note: Cluster-robust standard errors at the household level in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$. *F*-test statistic for weak IV is 898.607 with p-value of 0.00.

TABLE 3. Estimation results (2SLS; Amounts for remittances) continued

3. Loans

	Second Stage					
Variables	**(1) Availing family loans**	**(2 Availing formal loans**	**(3) Availing informal loans**	**(4) Availing family loans (female)**	**(5) Availing formal loans (female)**	**(6) Availing informal loans (female)**
Receive remittances (dummy)	-0.00324	-0.000774	-0.00174	-0.000709	-0.000164	-0.00232*
	(0.00749)	(0.00380)	(0.00251)	(0.00550)	(0.00228)	(0.00135)
Head's age	0.0330**	0.000574	0.000547	0.0140	-0.00223	-0.00155
	(0.0153)	(0.00261)	(0.00276)	(0.0144)	(0.00198)	(0.000957)
Square of head's age	-0.000375***	-6.05e-06	8.16e-07	-0.000121	2.61e-05	1.92e-05
	(0.000144)	(2.69e-05)	(3.07e-05)	(0.000134)	(2.09e-05)	(1.18e-05)
HH size including overseas members	0.0152	-0.00387	0.00169	0.0242*	-0.00110	0.00166
	(0.0154)	(0.00306)	(0.00344)	(0.0146)	(0.00189)	(0.00101)
Secondary or above education	0.00417	-0.0106	-0.00706	0.0220	-0.00468	0.000579
	(0.0529)	(0.0143)	(0.0206)	(0.0525)	(0.00809)	(0.00521)
Non-agricultural Occupation	0.0763	-0.00472	-0.0146	0.158	-0.000179	0.0114
	(0.0906)	(0.0117)	(0.0119)	(0.102)	(0.00627)	(0.00776)
Unemployment and business failure	-0.0361	0.0171	0.00634	-0.0626	0.00967	-0.000801
	(0.0725)	(0.0182)	(0.0171)	(0.0669)	(0.0158)	(0.00789)
Illness, accidents, and disasters	-0.0445	0.0243	0.0115	-0.0789	0.00692	-0.00333
	(0.0883)	(0.0180)	(0.0184)	(0.0652)	(0.0106)	(0.00324)
Crop failure	0.235***	0.0206	0.00800	0.0877	0.0171	-9.27e-05
	(0.0763)	(0.0201)	(0.0149)	(0.0700)	(0.0179)	(0.00633)
Family separation	-0.0222	0.0280	0.00438	0.116	0.0306*	0.00796*
	(0.123)	(0.0204)	(0.0215)	(0.0920)	(0.0181)	(0.00445)
Constant	-0.568	0.223*	-0.0127	-0.438	0.166	0.0231
	(0.417)	(0.131)	(0.0579)	(0.394)	(0.111)	(0.0177)
Observations	1,296	1,296	1,296	1,265	1,265	1,265
R-squared	0.243	0.181	0.484	0.273	0.121	0.827

Note: Cluster-robust standard errors at the household level in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

In summary, remittances are positively associated with the promotion of financial inclusion controlling after endogeneity using 2SLS with an instrumental variable and this is especially the case for women. The variables related to remittances are positive and significant in respect of having/using a bank account for household financial inclusion, whereas they are positive and significant for any financial accounts, a bank account, or a microfinance account concerning women's financial inclusion. Loans are not significantly related to remittances except that remittances make informal loans less dependent on women's financial inclusion. Thus, a substantial decline in remittances caused by the COVID-19 pandemic may discourage financial inclusion, in particular obtaining and using a bank account, for both men and women, and may discourage women from obtaining a microfinance account.[28]

[28] As a robustness check, we ran the regression separately for each round observations and obtained qualitatively the same results.

5. Discussion

We use the coefficients obtained in the 2SLS estimation in Table 3 to gauge the potential impact of the COVID-19 pandemic on financial inclusion in the Philippines. To do so, we use the per capita GDP predictions available for each country in 2020 from two economic outlooks—the International Monetary Fund (IMF)'s "World Economic Outlook" published in October 2019 and June 2020 and the World Bank (WB)'s "Global Economic Prospects" published in January and June 2020.[29] The outlooks published prior to the outbreak in October 2019 and in January 2020 serve as a "no-COVID" forecast. These forecasts helped us to construct the hypothetical *ECON* variable in the case where a global COVID-19 pandemic had not taken place. Conversely, the revised outlooks that were published in June 2020 after the outbreak of COVID-19, are used to construct the "with-COVID" economic scenarios. The "with-COVID" scenarios contain two cases in the "World Economic Outlook" and three cases in the "Global Economic Prospects". Details of the scenarios are given in Table 4.

We compute the predicted values by plugging the hypothetical *ECON* variables constructed using each of the different GDP per capita forecasts (three cases in the "World Economic Outlook" and four cases in the "Global Economic Prospects" both of which include the "no-COVID" case) for remittance-receiving households into our 2SLS estimates. We then compare the mean predicted values for the various outcome variables in each scenario. The difference between the "with-COVID" and the "no-COVID" scenario captures the potential impact of the COVID economic shock on financial inclusion. We acknowledge that this exercise depends on several assumptions. First, we assume that the change in the prediction of GDP in 2020 at the two different dates is entirely attributed to the pandemic, though some countries might have had a downward revision of the GDP prediction for 2020 without the COVID-19 outbreak. Second, we assume that the adverse effects caused by the COVID-19 pandemic including restricting migration through bans on international movement, limiting remittance transactions, and a stagnant economy in the host countries, is summarized in a negative change in per capita GDP and reflected in the *ECON* variable at the first stage regression.

Table 4 shows the potential impacts of the COVID-19 pandemic on financial inclusion for remittance-receiving households. The impacts are measured in percentage changes in the proportions of a variety of indicators of financial inclusion out of those proportions in 2017. We will focus on financial inclusion where coefficients on remittance were positive and statistically significant in Table 3. First, looking at household financial inclusion, we observed that the proportion of households who have/use a bank account may be reduced by ranging from 2.2 percent ("With-COVID 3" in WB) to 4.0 percent ("With-COVID 2" in WB).

[29] The initial outlook by the IMF after the pandemic was released in April 2020 and updated in June 2020.

TABLE 4. Impact of COVID-19 on financial inclusion of remittance-receiving household

	Percent changes, IMF		Percent changes, World Bank		
	With-COVID 1	With-COVID 2	With-COVID 1	With-COVID 2	with-COVID 3
(1) Household financial inclusion					
Having a bank account	-2.63	-2.45	-2.62	-4.01	-2.20
Actively using a bank account	-2.66	-2.48	-2.65	-4.05	-2.22
(2) Women's financial inclusion					
Having any financial accounts	-2.02	-1.88	-2.02	-3.08	-1.69
Actively using any financial accounts	-2.07	-1.93	-2.07	-3.16	-1.73
Having a bank account	-3.43	-3.19	-3.41	-5.22	-2.86
Actively using a bank account	-3.44	-3.20	-3.42	-5.24	-2.87
Having a microfinance account	-3.49	-3.25	-3.48	-5.31	-2.91
Actively using a microfinance account	-3.49	-3.25	-3.48	-5.31	-2.91
Availing informal loans	10.22	9.51	10.37	15.85	8.68

Note: IMF: Scenario "no-COVID" is based on the IMF's projection of GDP in 2020 as of October 2019.
Scenario "With-COVID 1" is based on the IMF updated projections for per-capita GDP growth for 2020 as of June 2020, assuming a gradual recovery after the second half of 2020. Global growth declines by 4.9 percent in this scenario.
Scenario "With-COVID 2" is based on the IMF updated alternative projections for per-capita GDP growth for 2020 as of June 2020, assuming that the pandemic recovery is faster than the baseline projections of June 2020. Global growth declines by 4.4 percent in this scenario.
WB: Scenario "no-COVID" is based on the WB's projection of GDP in 2020 as of January 2020.
Scenario "With-COVID 1" is based on the baseline scenario in the WB's June 2020 growth forecasts, assuming that the lockdown lasts until the end of the second quarter of 2020. The global output declines by 5.2 percent in this scenario.
Scenario "With-COVID 2" is based on the downside scenario, assuming that the lockdown lasts until the end of the third quarter of 2020. The world GDP declines by 8 percent in this scenario.
Scenario "With-COVID 3" is based on the upside scenario, assuming prompt recovery after the second quarter of 2020. The world GDP declines by 4 percent in this scenario.

Those results imply that a substantial reduction in remittance inflows caused by the pandemic may have adverse effects on household financial inclusion. Second, we see that the negative effect is serious for women's financial inclusion. The negative effect would be a reduction of 1.7 percent ("With-COVID 3" in WB) to 3.2 percent ("With-COVID 2" in WB) for the proportion of having any financial accounts, a reduction of 2.9 percent to 5.2 percent-5.3 percent for a bank account or a microfinance account. Moreover, the reduction of remittance makes those households more dependent on informal loans.

We see that financial inclusion is likely to be negatively affected by the pandemic. By type of financial institution, the COVID-19 pandemic may slow down the propensity of households to have a bank account and a microfinance account. In other words, the COVID-19 pandemic may deprive the country of a driving force to advance financial inclusion in those financial institutions. The adverse effects may be large for those banks in the country that charge maintenance costs to account holders, such as minimum balance requirements and dormancy fees.

These can penalize small-amount savers and non-active users of bank accounts. For account owners with large savings, reduced income from remittances would not affect the probability of them keeping the account as they are still able to stay above the threshold below which the bank account becomes too costly to hold. However, for marginal account holders with small amounts of savings, the shock may push their balance below the threshold. Therefore, the true effects of reduced remittances on formal financial inclusion can be non-linear stemming from the costs of holding an account and we can speculate that the negative impact of COVID-19 on people's financial inclusion may be disproportionately harder for the poorer segment of account holders. At the same time, there has been a growth in new and inexpensive financial services that utilize Fintech to save, borrow, and remit money; these new financial services are a substitute for a bank account. The new cashless financial services include mobile money and online money transfer services where the transaction costs are lower than those of banks.[30] Therefore, while the COVID-19 pandemic may weaken the forces for promoting formal financial inclusion through traditional financial services, this negative effect can be partially offset by new cashless financial services that use Fintech.

The potential adverse impacts that we have discussed must be understood in conjunction with several reservations. The exercise depends on the relationship between remittances and per capita GDP in the destination countries, which served as an instrumental variable. In order to discuss the impact of the COVID-19 pandemic on financial inclusion, we summarized all of the serial and complex decision-making processes around migration into the receipt of remittances and all aspects of the virus outbreak in relation to international remittances within a change in per capita GDP; this may call for a more nuanced approach to international restrictions on travels and remittance transactions. Moreover, we use household data from rural regions in the Philippines prior to the outbreak, which does not represent the national average. We find that respondents in our sample are comparable to the 2018 National Migration Survey (NMS) of the Philippines and that the individuals in our sample are slightly older and the proportion of college attendees or graduates is higher. Lastly, our empirical approach may not be able to fully capture the impact of the pandemic. It may be a partial and immediate effect assuming that local factors such as local financial transactions and did not change so much before and after the emergence of the pandemic given the recent boom of cashless transactions.

[30] World Bank [2020d]

6. Conclusion

This paper examined the relationship between remittance and financial inclusion in the Philippines and explored the potential impacts of the COVID-19 outbreak on financial inclusion. The pandemic is detrimental to remittance flow to developing countries, which is considered a driving force in the promotion of financial inclusion. We confirm that remittances are associated with financial inclusion, especially for women, and discuss that a substantial decline in remittances as a result of the COVID-19 pandemic may have adverse effects on financial inclusion in the Philippines.

To our knowledge, there has been little research utilizing microdata to explore how the COVID-19 pandemic will affect household financial inclusion. Future research should use the actual data in migrant-sending countries after the COVID-19 outbreak to quantify the adverse effects on household financial inclusion. The literature on remittances and financial inclusion using household data is not vast. While it is not easy to conduct a survey during the pandemic, together with our results, this line of research will be very informative for future policy responses.

Acknowledgments: This study was conducted as part of the project "Study on Remittances and Household Finances in the Philippines and Tajikistan" carried out by JICA Ogata Sadako Research Institute for Peace and Development. We would like to thank the institute for providing us with the dataset as well as Alvin Ang, Jeremaiah Opiniano, and Akira Murata for their data collection efforts. Our thanks also go to Yasuyuki Sawada, Aiko Kikkawa Takenaka, Daiju Aiba, Etsuko Masuko, and Shimpei Taguchi for their constructive comments and suggestions. Special thanks go to Pragya Gupta for her excellent research assistance. The views expressed in this paper are our own and do not represent the official positions of either the institute or JICA.

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The Philippine Review of Economics
57(1): 42-70. DOI: 10.37907/3ERP0202J

Forces of modernization and the welfare of rural households: a saga of a village in Central Luzon, 1977-2013

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This study aims to give a detailed account of how household sources of livelihood, income, and poverty change under the pressure of four modernizing forces: (1) population pressure on closed land frontier; (2) implementation of land reform; (3) expansion of public infrastructures such as irrigation systems, roads, and schools; and (4) growing urban influences accelerated by improvements in transportation and telecommunication systems. This study was conducted in a village in Central Luzon where recurrent household surveys were done for 36 years from 1977 to 2013 encompassing the period of dramatic diffusion of modern rice technology. The major finding is that the interaction between the four modernizing forces and the diffusion of modern rice technology resulted in major economic and social changes that led to a rise in household income and prevented poverty from increasing. This study provides evidence contrary to the popular belief that the spread of modern agricultural technology and the encroachment of market activities into rural villages are harmful to the economic welfare of the rural Filipino people.

JEL classification: O15, Q12, Q15
Keywords: poverty, inequality, irrigation, urbanization

1. Introduction

There is a widespread belief that the spread of new agricultural technology and penetration of market activities in rural villages tend to destroy existing economic institutions based on the principle of mutual help and income sharing, leading to unequal distribution of gains and further impoverishment of the rural poor.

In fact, during the heydays of the Green Revolution (GR) in Asia, concerns have been raised that the new rice technology tends to confer more benefits to large farmers compared with small farmers. Also, there was an observed acceleration in the spread of labor-saving technologies during the GR [David and Otsuka 1994],

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leading to further suspicion that the new rice technology has the effect of destroying labor employment opportunities for the landless poor. This suspicion persists despite studies showing that the new rice technology increases the demand for labor (in particular, hired labor for crop care activities and harvesting and threshing).

In more recent years, when the "steam" of GR is believed to have run out, rural villages are increasingly confronted with the pressure of commercialization penetrating the very core of rural household livelihood activities. Indeed, case studies in Asia have shown that rural households are increasingly getting more engaged in more commercialized nonfarm activities and getting away from rice farming [Estudillo and Otsuka 2016]. This is because of the decline in the size of operational landholdings due to closed land frontier and partible inheritance system, stagnation in rice yield, long-term decline in rice prices, and the increasing profitability of nonfarm activities relative to rice farming.

Importantly, in the case of the Philippines, beneficiaries of land reform experienced an increase in farm income because of the GR and the implementation of land reform that converted share tenants into either owner-cultivators or leaseholders with land rent prescribed by law set lower than the market rate. Pieces of evidence show that beneficiaries of land reform during the GR used their farm income to invest in the schooling of their children [Estudillo, Sawada, and Otsuka 2009], who, upon completing higher levels of schooling, migrated out of the villages to local towns, cities, and overseas while sending remittances back to the villages. As a result, the increase in nonfarm income has become the major source of household income growth and poverty reduction [Estudillo, Sawada, and Otsuka 2008]. Despite these shreds of evidence, however, the belief that urban-based market activities are not beneficial to the rural poor has persisted.

This research explores whether the new rice technology and market forces improved the well-being of the poor rural Filipinos. This paper gives a microscopic view of the dynamic processes underlying the changes in household sources of livelihood, landholdings and their distribution, and poverty in a Central Luzon village (henceforth referred to as the CLV) for nearly four decades encompassing the period of dramatic diffusion of modern rice technology under the pressure of four forces of modernization: (1) population pressure on a closed land frontier; (2) implementation of land reform; (3) expansion of public infrastructures such as irrigation systems, roads, and schools; and (4) growing urban influences accelerated by improvements in transportation and telecommunication systems. The main finding is that the interaction between the new rice technology and these modernizing forces did not necessarily lead to the impoverishment of rural households, as household income in the CLV did not decrease and poverty did not increase. Thus, contrary to the traditional belief that the new rice technology and commercialization are "evil twins", findings in the CLV indicate that, on the contrary, the interaction of modern rice technology with forces of commercialization are "combined friendly forces" that create economic benefits to the larger segment of the rural Filipino community.

This paper has four remaining sections. Section 2 describes the location of the CLV and enumerates the waves of surveys undertaken there. Section 3 presents an account of the evolution of the four modernizing forces and the spread of new rice technology. Section 4 explores how household sources of livelihood have changed and how poverty has declined over time. Finally, Section 5 is the summary and conclusion.

2. Approach to the village

2.1 Early settlement

The CLV is one of the *barangays* (local name for villages) in a city in the province of Nueva Ecija in the Central Luzon Region (the "rice bowl" of the Philippines). It is a small village known for its vast farmland, traditionally planted with rice in the wet season and with fruits and vegetables during the dry season. This village was randomly selected from an extensive survey of 50 villages, representing irrigated and rainfed lowland rice production environments in northern, central, and southern Luzon, as well as Panay Island [David and Otsuka 1994:52]. While the CLV is a representative of a typical lowland favorably rainfed in 1985, it was no longer the case in the last survey in 2013 with the opening of the CASECNAN irrigation system that started servicing the village in 2008.

The CLV was originally a forested area that the government opened up as a homestead and that attracted early settlers. As the CLV developed, it attracted landless workers to the village because of the high demand for labor in rice farming and the propagation of high-value crops and livestock. Landless workers were reported to have been present in the area even before 1939. In 1977, about 26 percent of the household heads in this village were landless workers [Dozina 1978].

During the early stages of CLV's development, most of the households were formed through intermarriage among local inhabitants. Dozina [1978] found that only 30 percent of the households interviewed in 1977 were formed through migration. The rest were formed through intermarriages of the local people. However, between 1992 and 2013, the total number of households who are immigrants to the CLV increased over time. A substantial number of immigrant households were landless workers, adding up to the burgeoning number of resident landless households in the village. The number of migrant households rose from 29 in 2004 to 70 in 2013; in both years, landless households made up 83 percent of all migrant households, and farmer-migrant households made up the remaining 17 percent (Table 1). The landless workers' major reason for migrating is to look for economic opportunities. The farmers' major reasons for migrating into the CLV are related to ownership of land (through inheritance or purchase) or marriage.

TABLE 1. Number of migrant households in the Central Luzon Village, 1992-2013

Type of household	No. of migrant households		
	1992	2004	2013
No. of households	230	381	509
No. of migrants*	31 (100)	29 (100)	70 (100)
Farmers	13 (42)	5 (17)	12 (17)
Landless	18 (58)	24 (83)	58 (83)

* Numbers in parenthesis are proportions to total migrants.

2.2 Waves of surveys

For 36 years, numerous household surveys were conducted in the CLV. The very first one was conducted by Geronimo E. Dozina in 1977 in line with the International Rice Research Institute (IRRI) Agricultural Economics Department's research project on agrarian adaptation to demographic and technological changes [Dozina 1978]. We used Dozina's data as our baseline information. Dozina conducted a complete enumeration of households in the CLV between August and November 1977, covering the crop year 1976-77 (wet season crop in 1976 and dry season crop in 1977).

IRRI made a follow-up survey in 1985 (under the leadership of Cristina C. David and Keijiro Otsuka) [David and Otsuka 1994] and again in 1992 and 1997 (under the leadership of the late Mahabub Hossain). The IRRI surveys were aimed at assessing the impact of modern rice technology on household income distribution. The 2004 and 2008 surveys were conducted by Jonna P. Estudillo and Keijiro Otsuka (Estudillo et al. [2008]; Estudillo et al. [2014]) with generous funding from the Foundation for Advanced Studies on International Development (FASID) and the National Graduate Institute for Policy Studies (GRIPS), which are both located in Tokyo, Japan. The Estudillo-Otsuka surveys explored how the adoption of modern rice technology has impacted household investment decisions on human capital, including children's schooling and migration to local towns, cities, and overseas. The latest survey was in 2013, conducted by the two authors of this paper with generous funding from the GRIPS Emerging State Project JSPS KAKENHI Grant Number 25101002 under the leadership of Tetsushi Sonobe of GRIPS. This latest survey was simply an update of the IRRI past surveys to identify sources of household income growth and assess changes in poverty and household income inequality in the village.[1]

Our analysis in this paper is based mainly on household surveys in 1977, 1992, 2004, and 2013. We have chosen those years because those surveys were conducted for all households living in the CLV (i.e., complete enumeration survey). The 1985

[1] Supplemental surveys include those undertaken by Quisumbing [1994] on land inheritance and schooling decisions; by Nagarajan, Quisumbing, and Otsuka [1991] on credit contract; and by Hayami and Otsuka [1993] on land contracts.

survey was conducted for only a representative sample set of households. While complete enumeration was undertaken in 1997 and 2008, we believe that those years are not normal survey years. The Asian financial crisis was in 1998, which is a year immediately following the 1997 survey. CASECNAN started its irrigation service to the CLV in 2008 on a limited scale and the Asian rice crisis took place in 2008.

2.3 Number of households

In 1977, only 118 households lived in the CLV. This number increased to 230 in 1992, 381 in 2004, and 509 in 2013 (Table 2). The total village population rose from 649 people in 1977 to 2,925 people in 2013. This means that the village population was rising by 4.2 percent annually, which was higher than the national average of 1.6-2.8 percent between 1977 and 2013. While we cannot identify the contribution of natural increase and in-migration to total population increase, it is reasonable to speculate that in-migration has the greater contribution, considering that urban centers are fairly accessible to the CLV. Also, employment opportunities in agriculture within the village have increased due to the spread of modern rice technology, the development of irrigation, and the increasing popularity of the propagation of high-value crops, livestock, and poultry during the slack season.

TABLE 2. Distribution of households, by household head occupation, in the Central Luzon Village, 1977-2013

Occupational category of household heads	1977		1992		2004		2013	
	No.	%	No.	%	No.	%	No.	%
Farmers	88	74	134	58	129	34	142	28
Landless workers	30	26	96	42	252	66	367	72
a. Agricultural landless	15	13			150	39	164	32
i. Daily wage workers					92	24	87	17
ii. *Porcientuhan*					58	15	77	15
b. Non-agricultural landless	15	13			102	27	203	40
Total	118	100	230	100	381	100	509	100

We classified households into two major categories: (1) farmer and (2) landless households. We classified households based on the main occupation of the household heads, who are predominantly the male spouse. By farmer households, we mean the head is a rice farmer because rice is the main crop. Rice farmers include owner cultivators, leasehold tenants, and share tenants. Landless households are further categorized into three major groups: (1) daily wage workers, (2) *porcientuhan* workers, and (3) non-agricultural workers.

Daily wage workers are those who eke out their living from daily wage work in transplanting and weeding. This group is observed to be the poorest in the CLV. *Porcientuhan* workers are engaged in a labor contract called the "*porcientuhan* contract", which commonly lasts for two years. Under this contract, the laborer receives 10 percent of the gross rice production as payment for land preparation and crop care activities such as fertilizer and insecticide application and weeding. Non-agricultural workers are those who are employed in wage work in the formal sector (private and public) and informal sector (transport, retail trade, services, etc.) and those who are self-employed.

In 1977, 74 percent of households in the CLV were headed by rice farmers, and the remaining were headed by agricultural landless workers (13 percent) and non-agricultural workers (13 percent) (Table 2). There was a remarkable decrease in the proportion of households headed by rice farmers from 74 percent in 1977 to 28 percent in 2013. This is because of the increasing scarcity of rice farms due to high population growth in a regime of closed land frontier. While there was no formal account of when forestlands were exhausted, we speculate that the land frontier was closed in the early 1950s. Thus, it is not surprising that a majority of households in the CLV in 2013 were headed by non-agricultural workers (40 percent), daily wage workers in agriculture (17 percent), and *porcientuhan* workers (15 percent) (Table 2). Given that rice farming has become a less important source of livelihood in the CLV, we can reasonably speculate that the impact of modern rice technology on household income growth, poverty, and inequality in the CLV is much less in more recent years compared with the first survey in 1977.

3. Modernizing forces and new rice technology

Here we trace one by one the various influences of the four forces of modernization on the socio-economic fabric of the CLV. The four modernizing forces are (1) population pressure on a closed land frontier; (2) implementation of land reform; (3) expansion of public infrastructures such as irrigation systems, market infrastructure (roads and bridge), and schools; and (4) growing urban influences accelerated by improvements in transportation and telecommunication systems. Incidentally, the emergence of those forces coincided with the spread of the new rice technology and thus we also identify various forms of interaction between those modernizing forces and the new rice technology.

3.1 Population pressure

Population pressure means a high growth rate of the labor force on a closed land frontier. Population pressure results in a decline in farm size, which causes poverty because the farmland is the main source of household income in the early stage of development (Hayami and Kikuchi [2000]; Estudillo and Otsuka [1999]).

Table 3 shows various indicators of population pressure in the CLV (man/land ratio, land/family ratio, land/farmer household ratio, land/person ratio). All of those show a large decline from 1977 to 2013, indicating that population pressure was strong in the village. Also, there appears to be a conversion of rice farms into residential and other uses, importantly irrigation canals for the CASECNAN irrigation system, as shown by the decline in crop area. The increasing scarcity of farmland is expected to lead to impoverishment in the CLV. However, this did not happen because of the spread of modern rice technology and increased employment opportunities in the nonfarm sector as local towns, small cities, and big cities develop further and become more accessible to the villagers.

TABLE 3. Indicators of population pressure in the Central Luzon Village, 1977-2013

Item		1977	1992	2004	2013
Size of the village (ha)	[A]	301	301	301	301
Crop area (ha)	[B]	301	250	242	210
Total population	[C]	649	1110	2292	2925
Total no. of households	[D]	118	230	381	509
Total no. of farmers' households	[E]	88	134	129	142
Population density (man/land ratio)	[F]	2.2	3.7	7.6	9.7
Population pressure over the land					
a. Land/family ratio	[A/D]	2.6	1.3	0.8	0.6
b. Land/farmer hh ratio	[A/E]	3.4	2.2	2.3	2.1
c. Land/person	[A/C]	0.5	0.3	0.1	0.1

Hayami and Ruttan [1985] pointed out that population pressure induces the spread of land-saving technology (or seed-fertilizer technology). The GR started in the Philippines in 1966 with the release of the first modern variety (MV) of rice (IR8) by IRRI. As early as 1977, the adoption ratio of MVs was close to 100 percent. The proportion of farmers using fertilizer rose from 60 percent in the wet season of 1977 to nearly 100 percent in 1992. The proportion of those using pesticides rose from 1977 to 1992 but then dropped in 2004 and 2013, presumably because of the spread of the integrated pest management technology that decreases the use of pesticides. The proportion of farmers using mechanical technology such as tractors and threshers rose continuously from 1977 to 2013 because of increases in wages that induced farmers to substitute machines for labor to minimize labor costs. The rapid spread of modern seeds and mechanical technology suggests that the CLV was a frontrunner in the adoption of modern rice technology (Table 4).

TABLE 4. Adoption of modern rice technology in the Central Luzon Village, 1977-2013

	1977		1992	2004	2013	
	Wet	Dry	All seasons	All seasons	Wet	Dry
No. of observations	83	43	131	129	140	134
% of modern rice users	98	100	93	96	99	98
% of fertilizer users	60	88	99	NA	97	96
% of pesticide users[1]	71	74	95	73	74	78
% of tractor users	34	30	52	100	76	79
% of threshing machine users	49	100	94	98	95	95

* Chemical herbicides and insecticides.
* NA – not available

As a result of the adoption of MVs, yield rose from four tons per hectare in 1985 to 6.1 in 2013. Because of the development of the irrigation system from groundwater extraction (called in the CLV as deep water pump) in the mid-1990s to gravity system in the late 2000s, rice cropping intensity index (or the number of rice crops per unit of land per year) rose from about one per year in 1985 (when the village was rainfed) to nearly two per year in 2013 (when CASECNAN irrigation services reached the village). MV technology is labor-using because it needs greater labor input in crop care activities such as fertilizer and pesticide application and weeding as well as in harvesting and threshing due to the higher yield. Moreover, the increase in cropping intensity entails more labor input per unit of land every year. The increase in cropping intensity brought about by the availability of irrigation and the use of MVs with a shorter growing period enabled the farmer to use the same piece of land more than once every year–during the late monsoon season in November in the case of rainfed farms and during the dry season in the case of irrigated farms.

The spread of new rice technology increased labor employment opportunities in the CLV, which is beneficial to the landless poor whose main source of income is daily wage work in rice farming. The increasing availability of income-earning opportunities in rice farming attracted in-migrants from neighboring villages that partially contributed to the burgeoning number of landless households in the CLV (Table 1). While the new rice technology confers economic gains to both the landless poor and the farmer households, much of the gains accrue to the farmer households. For the farmer households, gains in the new rice technology come from higher yield and greater production per unit of land per year due to higher cropping intensity. Factor-share analysis in rice farming in the CLV shows that a higher proportion of gross output goes to land (33 percent compared with 26 percent for labor), indicating that substantial gains from the new rice technology accrue to the owner of the land (i.e., farmer households) compared with the owner of labor (i.e., landless laborer) [David and Otsuka 1994:100].

3.2 Land reform

The *hacienda* system was prevalent in Central Luzon and almost all farmers were share tenants in the region before the implementation of land reform in 1972. The major purpose of the land reform program is to transfer land to the actual cultivators (land-to-the-tiller) and promote leasehold tenancy (operation leasehold) in place of share tenancy. The land ceiling was seven hectares and share tenants whose landlord owned more than seven hectares were converted to amortizing owners and eventually to full owners after paying amortization fees to the Land Bank of the Philippines for 15 years (land-to-the-tiller program). Share tenants whose landlord owned less than seven hectares were converted to leaseholders (operation leasehold program). Amortization fees and leasehold rent were fixed by law at a rate below the market return to land so that there were sizable gains in returns to land that accrue to the former share tenants. The land reform was most effectively implemented in favorable rice-growing areas, including Central Luzon [Otsuka 1991]. As a result, there was a high incidence of owner cultivators and leaseholders in the CLV in 1992, and that there has been no single remaining share tenant in the CLV since 1992.

There was a modest increase in the incidence of mortgaging (or land pawning) over time (Table 5), which was rare in the CLV in the distant past. The borrower pawns out the land to a lender while surrendering her/his cultivation rights to the land in exchange for a loan. The land comes under the control of the lender, who may decide to become the tiller of the land or otherwise hire a *porcientuhan* worker. The borrower keeps the land until such time that the borrower is able to pay back the loan. While the transfer of cultivation right to the third person is deemed illegal by law, the landowner does not care as to who cultivates the land as long as land rent is paid. According to Nagarajan, Quisumbing, and Otsuka [1991], pawning arrangements evolved more commonly among leasehold lands because economic rents were created by the land reform law. Such rents are equal to the divergence between market returns to land (proxied by share tenancy rents) and leasehold rent fixed by the land reform law, which creates a positive transaction value to leasehold rights.

Another important change in the agrarian structure in the CLV is the emergence of *porcientuhan* contract, which did not exist in 1977 and 1992, but appears to have become common in 2004 and 2012. The proportion of rice area under *porcientuhan* contract rose from nil in 1992 to more than 50 percent in 2004 and 2013 (Table 5). As early as the 1990s, Hayami and Otsuka [1993] observed the emergence of a type of labor contract (*kasugpong* or *porcientuhan*) in the Central Luzon region of the Philippines. Under this contract, the *porcientuhan* worker supplies labor for the share of gross output at 10 percent, while the landlord takes care of all the costs, including the wages of casual labor employed in peak seasons.

TABLE 5. Tenure of cultivated plots of households in the Central Luzon Village, 1992 to 2013

	1992		2004		2013	
	Parcels	**Area**	**Parcels**	**Area**	**Parcels**	**Area**
Owned	82	93	103	98	94	54
	(44)	(37)	(46)	(29)	(42)	(26)
Leased	79	128	19	24	29	24
	(42)	(51)	(8)	(7)	(13)	(11)
Mortgaged	15	18	18	28	16	13
	(8)	(7)	(8)	(8)	(7)	(6)
Borrowed	9	9	11	12	5	11
	(5)	(4)	(5)	(4)	(2)	(2)
Shared-tenant	0	0	0	0	0	0
	(0)	(0)	(0)	(0)	(0)	(0)
Others	3	3	0	0	5	2
	(2)	(1)	(0)	(0)	(2)	(1)
Porcientuhan	0	0	73	180	75	108
	(0)	(0)	(33)	(53)	(33)	(51)
Total	188	250	224	342	224	210
	(100)	(100)	(100)	(100)	(100)	(100)

Note: Numbers in parenthesis are proportions to total.

Table 6 provides some characteristics of the *porcientuhan* households. It is interesting to note that, in spite of the increase in the number of *porcientuhan* households from 58 in 2004 to 77 in 2013, some socioeconomic characteristics of *porcientuhan* households remained the same. The average size of a *porcientuhan* household was around five persons in a household in 2004, and this has remained unchanged in 2013. The proportion that had electricity slightly increased from 76 percent in 2004 to 79 percent in 2013, while households that have access to sanitary toilet facilities remained unchanged between 2004 and 2013 at 86 percent.

Heads of *porcientuhan* households have, on average, 12 years of schooling in 2004 and seven years of schooling in 2013. This indicates that the more educated *porcientuhan* workers (those with more than primary schooling) have retreated from *porcientuhan* work to other jobs that are presumably better paying. A cursory check of the data for 2013 indicates that *porcientuhan* workers have relatively the same level of education as agricultural landless workers (about seven years). Farmers, on the other hand, have a relatively higher level of education (nine years), while non-agricultural workers have eight years, on average. In terms of age, the heads of *porcientuhan* households have become considerably younger. In 2004, the average age of *porcientuhan* households was 50 years old, while in 2013, it was 42. It seems that, in more recent years, the *porcientuhan* workers are the young and less educated people who have few employment opportunities outside rice farming.

In terms of relationship to the landlord, most of the *porcientuhan* household heads (63 percent in 2004; 62 percent in 2013) were not related to their landlord. In 2004, those who are directly related to the household head comprised only seven percent of *porcientuhan* workers, while the proportion of those who are distantly related to the household head was at 30 percent. No significant change in the proportions was observed in 2013.

TABLE 6. Socioeconomic characteristics of *porcientuhan* households in the Central Luzon Village, 2004 and 2013

	2004		2013	
No. of households	57		77	
Average household size (no. of members)	5		5	
Education of household head (yr)	12		7	
Age of household head (yr)	50		42	
Proportion with electricity	76		79	
Proportion with sanitary toilet	86		86	
Relation to landlord (%)				
Direct relative	7		6	
Distant relative	30		32	
Not related	63		62	
Average POR share (%)	10		10	
Average size of POR land (ha)	2		2	
Residence of landlord (%)				
Within CLV	42		34	
Outside CLV but in the city	44		54	
Outside NE	14		12	
Farm income (PPP US$)*	187	(6)	1,873	(35)
Non-farm income (PPP US$)	2,497	(85)	3,268	(61)
Remittances (PPP US$)	243	(8)	225	(4)
Total income (PPP US$)	2,927	(100)	5,366	(100)

*Numbers in parenthesis are proportions to total income.

Hayami and Otsuka [1993] attributed the proliferation of *porcientuhan* to the implementation of land reform, the development of new rice technology, withdrawal from farming, and the transfer of land cultivation to urban residents. The emergence of the *porcientuhan* contract is most importantly attributed to the implementation of the land reform law that made sharecropping illegal. If share tenancy is not illegal, landlords could have opted to hire a share tenant because share tenancy has a built-in labor incentive mechanism in the presence of costly labor supervision of a *porcientuhan* worker. Share tenants receive 50 percent of the gross output, whereas *porcientuhan* workers receive only 10 percent. The work incentive mechanism is thus stronger under a share tenancy contract. Because

the *porcientuhan* workers are inefficient (they do not exert optimal effort), there has been frequent hiring and firing of *porcientuhan* workers and their contract commonly lasts for only about three to four cropping seasons (about two years).

The *porcientuhan* contract is commonly observed only in irrigated areas in Central Luzon, but not in rainfed areas. As mentioned above, the *porcientuhan* contract was first documented in the CLV in the 2004 survey. In the early 2000s, the irrigation system started to develop in the village with the introduction of deep well water pumps for groundwater extraction. Thus, the rising incidence of *porcientuhan* in the CLV could be explained by the increase in productivity of agricultural land brought about by the access to irrigation first through groundwater extraction and, more decisively, by the opening of the CASECNAN national irrigation system in 2008. Moreover, the released rice varieties from 2004 and 2013 incorporated better traits such as high yield capacity, resistance to multiple pests and diseases, shorter growth duration, and better grain quality. Rice with better grain quality tends to command a higher price in the market.

The *porcientuhan* arrangement was also seen as an "institutional innovation" that caters to the demand of land-reform beneficiaries in the CLV who want to withdraw from working on the farms while at the same time holding on to their land ownership titles or leasehold rights. The *porcientuhan* contract is an imperfect substitute to a tenancy contract while it can be claimed as a labor-employment contract [Hayami and Otsuka 1993:156], which is legal under the land reform law.

The rising incidence of *porcientuhan* workers is partly because of the rising incidence of land sales to people living outside the CLV, either within the municipality or even farther outside the province. The proportion of *porcientuhan* workers reporting their landlords as living outside the CLV rose from 58 percent in 2004 to 66 percent in 2013, while the proportion of those whose landlords live within the CLV declined from 42 percent to 34 percent. As these outside residents could not possibly farm the land, they would resort to a *porcientuhan* contract. We were able to document a rise in the incidence of land sale from seven parcels in 2004 to 19 parcels in 2013. The three most common reasons for land sale in 2013 were consumption expenditure, debt repayment, and medical expenses (or distress sale) (40 percent of sold parcels); production expenses (33 percent); and education (10 percent).

An important inquiry is why the *porcientuhan* contract became popular among the landless agricultural workers. The bottom panel of Table 6 indicates that there has been a drastic improvement in total farm income obtained by the *porcientuhan* households. From around $187 PPP 2005 in 2004, the average annual farm income in 2013 has increased tenfold to about $1,873 PPP 2005. This is largely because of the emergence of double cropping in the CLV due to CASECNAN and the rise in rice prices since the Asian food crises in 2006-2008. Nonfarm income has also increased from 2004 to 2013, albeit only slightly, while remittances have

slightly declined. Overall, technical change in terms of irrigation and rise in rice prices has improved the income status of *porcientuhan* households, making the *porcientuhan* contract an attractive alternative to casual daily work in agriculture and low-level nonfarm jobs.

Urbanization may have also resulted in the proliferation of *porcientuhan* contracts. Table 6 also shows the location of the residences of landlords for whom the *porcientuhan* workers work. Hayami and Otsuka [1993] observed that these urban dwellers have a relatively high cost of monitoring daily farm workers so they resort to the *porcientuhan* arrangement because share tenancy is prohibited by law. As mentioned earlier, some of the urban dwellers who hired *porcientuhan* workers are recipients of pawned-out farmland who could not cultivate the land themselves, thus resorting to a *porcientuhan* contract.

To sum up, we have presented changes in agrarian structure in the CLV from 1992 to 2013, highlighting the predominance of owner cultivators as a result of the land-to-the-tiller program, the modest incidence of mortgaging arrangements, and, importantly, the rising incidence of *porcientuhan* contracts. The immediate cause of the emergence of *porcientuhan* contracts was the land reform regulation that made the land rental market inactive by making share tenancy illegal, subsequently removing the opportunity for the landless agricultural workers to rent land for their own cultivation. Under a perfectly competitive land market, share tenancy will be chosen over *porcientuhan* contract because share tenancy provides an effective incentive mechanism in the presence of costly labor supervision of *porcientuhan* workers. As we shall show later, despite the prohibition of share tenancy ("demise of the agricultural ladder"), the lot of landless workers did not deteriorate because of the increased employment opportunities in rice farming brought about by the new rice technology and retreat of the more well-to-do farmers from farm work, and, more decisively, because of the increased employment opportunities in the booming nonfarm sector.

3.3 Infrastructure development

Market infrastructure: It refers to roads and a bridge in the CLV. The CLV is located about four kilometers of the city proper, which is in turn just one kilometers from the Pan-Philippine National highway that traverses the middle of the city from north to south. In the middle of the CLV is a provincial road that connects the city to the nearby municipality. Just below the village boundary is a national highway called the Nueva Ecija-Pangasinan highway that connects the two provinces. The CLV is a commuting distance from a state university and a rice research institute (both located within the city) and even to the more urbanized San Jose City to the north and Cabanatuan City to the south. Within the CLV, the main streets are cemented and farm-to-market roads are cleared and paved with gravel. It is clear the CLV is strategically located to have fairly good access to urban labor markets and new rice technology.

In the first survey in 1977, the CLV has no bridge, making it isolated from the city proper. By the mid-1990s, a concrete bridge crossing the Baliwag River bordering the village from the west was constructed. This reduced the transport cost of residents and their goods. Importantly, the new bridge enabled young children to complete a full six years of primary schooling and even attend secondary and tertiary schools located outside the CLV. In earlier years, the single primary school within the CLV offered only four years of primary schooling, which is two years less than the compulsory six years to complete primary schooling.

While there was no data on access to electricity in 1977 and 1992, we found that about 85 percent of households had access to electricity in 2003 and 2014. Electricity is important in the development of small- and medium-scale enterprises and a time-saving infrastructure that releases time of women away from domestic work to market work. For young girls, it releases them of responsibility at home after school, thereby allowing them to attend schools and spend more time studying after class.

It is important to mention that improvement in the supply of public goods in the CLV has been facilitated by the passage of the Local Government Code in 1992, which significantly increased the internal revenue allocations from the national government to the local governments. This bill was intended to provide greater funding for village-specific needs, including those related to market and social infrastructure (e.g., school buildings, clinics, etc.). In addition to this, there has been an increase in the leadership competency of local mayors (equipped with engineering and doctoral degrees) since the early 1990s, which resulted in greater local revenue collections and internal revenue allocations and other improvements in local governance, including its early computerization of real estate tax collections.

Irrigation: In the late 1970s, most of the farmlands in the CLV were rain-fed farms, while a few farms were able to use groundwater pumps for irrigation during the dry season [Dozina, 1978]. By 1992, the CLV became partially irrigated by deep well pumps and, by 2013, the CLV is almost fully irrigated by the CASECNAN irrigation system. Table 7 shows that 47 percent of its rice area was irrigated by pumps in 1992 and 88 percent by the gravity irrigation system in 2013. It is important to mention that the rental market for water pumps evolved in the early 1990s to mid-2000s in response to the rising demand for irrigation water in rice production and, importantly, in the production of high-value crops such shallots and watermelon. In fact, based on our own recollection during the previous surveys, there were a few large farmers who owned water pumps and rented them out to other farmers as an additional source of household income. The development of irrigation systems in the CLV has become one important driver of household income growth from rice production through double cropping and through diversification to the production of high-value crops (the so-called high-value revolution).

TABLE 7: Area irrigated, by source, in the Central Luzon Village, 1992-2013

Source of irrigation	1992	2004	2013
National irrigation system (ha)	0	0	184
	(0%)	(0%)	(88%)
Underground water extraction (ha)	117	153	3
	(47%)	(63%)	(1%)
Rainfed (ha)	133	89	23
	(53%)	(37%)	(11%)
Total rice area (ha)	250	242	210
	(100%)	(100%)	(100%)

3.4 Growing urban influences

Rapid urbanization is occurring within the vicinity of the CLV. Rapid urbanization means the rapid rise in the population of the neighboring cities surrounding CLV, particularly, Cabanatuan, San Jose, and the Science City of Muñoz (Figure 1). The rapidly increasing population growth and development of urban cities near the CLV may be drawing the people living in the CLV to engage in nonfarm work in the nearby cities. Households who rely on agriculture income (i.e., farmers) tend to live in the area of the village that is far from the urban areas, whereas non-agricultural households, daily wage worker households, and *porcientuhan* households tend to live near the urban area. These three groups of households depend on nonfarm livelihood for their income, either for a large portion of it (as in the case of non-agricultural households) or a small part of it (as in the case of the households of daily wage and *porcientuhan* workers). Living within easy access to the urban area reduces the transaction cost of earning a living.

3.5 Human capital

Accumulation of human capital in terms of education and migration is an important pathway out of poverty. In the CLV, we notice an improvement in schooling attainment of its population as reflected by the distribution of the population by educational attainment (Table 8).

TABLE 8: Distribution of population, by educational attainment, in Central Luzon Village, 1977-2013

Educational level	1977		1992		2004		2013	
	No.	%	No.	%	No.	%	No.	%
1. Non-schooling age	112	17.3	198	17.8	285	12.4	341	11.7
2. No education	43	6.6	21	1.9	67	2.9	72	2.5
3. Primary level (unfinished)	151	23.3	291	26.2	348	15.2	900*	30.8
4. Primary level (completed)	198	30.5	243	21.9	451	19.7		
5. High school (unfinished)	64	9.9	148	13.3	339	14.8	412	14.1
6. High school (completed)	57	8.8	135	12.2	477	20.8	727	24.9
7. College (unfinished)	18	2.8	45	4.1	171	7.5	276	9.4
8. College(completed)	6	0.9	29	2.6	154	6.7	197	6.7
Total	649	100.0	1110	100	2292	100.0	2925	100.0

* Includes primary (unfinished) and primary (completed).

The share of the population with no education has decreased from 6.6 percent in 1977 to only 2.5 percent in 2013 (Table 8). Similarly, the proportion of the population with limited education (primary [unfinished] and primary [completed]) has decreased from a combined total of about 53.8 percent in 1977 to just about 30.8 percent in 2013. This is because of the upgrade of the primary school in the village, which went from a school that only reached grade 4 to grade 6 (full years of primary school). Despite the CLV not having a high school within the village, the proportion of the high school-educated population (unfinished and graduate combined) has more than doubled from 18.7 percent to 39.0 percent in 2013. We presume that this is partly because of the construction of the bridge that connects the CLV with city proper, where high schools are located, and partly because of the rise in household income that gave households the ability to pay the out-of-pocket cost of high school education. Republic Act (RA) 6655 "free public secondary education act" of 1988 is another contributory factor to the rise in the number of people with high school education.

The number of people in the CLV with a college education in 1977 was only 24 (3.7 percent of the total village population), but this has sharply increased to 74 people in 1992 (6.7 percent). Then, it further increased to 325 people in 2004 (14.2 percent) and further to 473 people in 2013 (16.1 percent). Obviously, there was a rising trend in parental investment in college schooling even though the parents have to pay higher out-of-pocket costs consisting of school fees and board and lodging for those schools that are not within commuting distance to the CLV.

The improvement in human capital is also supported by Table 2 from which it can be inferred that an increasing number of household heads are able to engage in work in the nonfarm sector. These heads are commonly the more educated members of the community. The proportion of households headed by non-agricultural workers rose from 13 percent in 1977 to 40 percent in 2013. Such shift in occupational choice of household heads could have been facilitated by the rise in schooling attainment of people in the CLV and the increase in demand for the more educated laborers in the nonfarm sector in local towns and cities that are easily accessible from the CLV.

An increase in schooling attainment of the younger generation could be attributed to three factors: (1) increased household income, (2) rising returns to schooling, and (3) declining cost of schooling borne by parents. The latest was facilitated by the free primary education since the American colonial era and by the free secondary public schooling in 1988. Rising household income can be attributed to the increasing profitability of rice farming due to the expansion of the irrigation system and partly due to favorable rice prices that continued on since the rice crises in 2006-08. High-value revolution in terms of high-value crops and livestock production appears to have started in the CLV before the opening of the CASECNAN irrigation system, but then it appears to have declined because rice farming with double cropping became more profitable than the cultivation of

high-value crops. Nonfarm employment opportunities in the government sector, nearby research centers and universities, and, importantly, in the retail trade, transport, construction, and communication sector, have started to evolve in the CLV, leading to higher nonfarm income and higher total household income.

Following the literature, we consider migration as an investment in human capital. Because of the strategic location of the CLV and its accessibility to local towns and small cities and, to some extent, even to Metro Manila, we notice frequent seasonal outmigration of landless male casual daily wage workers to work on construction projects outside the CLV during the slack agricultural period. Women also migrate but mostly for domestic work. The younger generation belonging to the landless households has a higher tendency to migrate locally and even overseas [Estudillo et al. 2014]. Given the importance of migration, remittances have become an important source of income, particularly among landless households as will be discussed below.

4. Changing sources of livelihood and poverty

The preceding sections have presented the evolution of modernizing forces that greatly affected the economic and social fabric of the CLV. We then proceed to the analysis of processes by which the evolution of the four modernizing forces has affected the level and distribution of income as well as poverty in the CLV.

4.1 Changes in household income structure

Table 9 shows a snapshot of the average income of farmers and landless workers in the CLV from 1997 to 2013 when income data are available. We classify income into three major classifications: farm income, non-farm income, and remittances.

Farm income includes wages earned from working on the farm and net income from rice, other crops, and livestock and poultry. Wage earnings include income earned by being hired as farm laborers for farm tasks such as land preparation, transplanting, weeding, harvesting, and threshing. Farm income includes the imputed value of owner-produced agricultural goods such as rice, fruits and vegetables, and poultry and livestock products. Households are also able to earn income from non-farm enterprises, which include net income from sari-sari stores and other retail trade, tricycle driving, and ownership of other businesses including cottage industries. Non-farm wage earnings are being derived from working in the formal sector as being employees of the government and private entities and working in informal non-agricultural enterprises. Remittances are income (both in cash and in-kind) that was sent to the household by someone who is away from the household. The value of remittances in kind was imputed by the respondent and added to the total income of the household. Household income in Table 9 is shown in terms of US$ PPP in 2005.

Average income of farmer households rose from $670 in 1977 to $3,126 in 1992 to $8,151 in 2004 to $15,128 in 2013. For landless households, household income rose from $499 in 1977 to $1,703 in 1992 to $4,878 in 2004 to $7,341 in 2013. It is noticeable that in a span of only 9 years from 2004 to 2013, farmer household income rose by 1.8 times and that of landless households by 1.5 times. It was in 2004 and 2013 when household income rose more markedly. For both farmer and landless households, nonfarm income was the major contributor to the rise in total household income. Farm income (largely from rice) and remittances mainly coming from members living outside the village contributed modestly to the rise in total household income. The ratio of farmer household income to landless household income rose from 1.34 in 1977 to 2.06 in 2013, indicating a deterioration in income inequality in the village. This is mainly because of the in-migration of poorer households from other villages to the CLV, attracted mainly by the growing employment opportunities in this newly irrigated village.

TABLE 9. Sources of household income (PPP in 2005) in Central Luzon Village, 1977-2013

Source	1977		1992		2004		2013	
	Farmers	Landless	Farmers	Landless	Farmers	Landless	Farmers	Landless
1. Farm income	398	241	1,774	717	2,229	342	3,856	598
	(59)	(48)	(57)	(42)	(27)	(7)	(25)	(8)
1.1 Wage*	56	196	194	578			392	508
	(8)	(39)	(6)	(34)			(3)	(7)
1.2 Rice	224	0	1,186	0	1,482	0	2,682	0
	(33)	(0)	(38)	(0)	(18)	(0)	(18)	(0)
1.3 Other crops	118	45	196	76	747	342	127	28
	(18)	(9)	(6)	(4)	(9)	(7)	(1)	(0)
1.4 Livestock			198	63			656	62
			(6)	(4)			(4)	(1)
2. Non-farm income	271	259	1,071	553	5,191	3,919	9,638	5,629
	(41)	(52)	(34)	(32)	(64)	(80)	(64)	(77)
2.1 Non-farm wage	158	207	618	236			5,713	3,263
	(24)	(41)	(20)	(14)			(38)	(44)
2.2 Non-farm enterprises	114	52	453	317			3,925	2,367
	(17)	(10)	(14)	(19)			(26)	(32)
3. Remittances	0	0	281	433	731	617	1,634	1,113
	(0)	(0)	(9)	(25)	(9)	(13)	(11)	(15)
Total	670	499	3,126	1,703	8,151	4,878	15,128	7,341
	(100)	(100)	(100)	(100)	(100)	(100)	(100)	(100)

* Data for wages in 2004 included in Rice and other crops
Note: Numbers in parenthesis are shares to total.

For both the farmer and landless groups, the share of farm income has been steadily declining over time, while the share of nonfarm income has sharply risen sometime after the conduct of the 1992 survey (Table 9). Over time, the share of non-rice income has also declined mainly because of the increasing profitability

of rice production due to double cropping. As the share of farm income decreases across time for both farmers and landless workers, the share of nonfarm income increases. Landless workers in 2013 have more than three-quarters of their total income coming from nonfarm income, indicating that nonfarm work is more lucrative for this group whose main asset is their labor. For farmers, the proportion is about two-thirds.

For the landless households, the share of remittances to total income has sharply increased from 0 percent in 1977 to 25 percent in 1992. Part of the increase may be attributed to the fact that, in the 1980s, Filipinos started to explore job opportunities overseas such as the Middle East and East Asia. Landless people are more likely to migrate outside the village, even for overseas. In 2004, the share of remittances to total income was only 13 percent for landless households, which slightly increased in 2013 to 15 percent. Remittances have also become a major source of income for farming households. In 1992 and 2004, the share of remittances to total income for farmers was around 9 percent, but this has increased slightly to 11 percent in 2013 (Table 9). Because farmers are able to earn from agricultural production (e.g., rice), the decision to migrate outside of the CLV is a less important option compared with the landless workers.

So, how do the four modernizing forces affect the growth of household income? The spread of new rice technology such as the adoption of newer MVs with better characteristics (e.g., resistance against pests and diseases and shorter growing period) as well as the expansion of irrigation that made double cropping of rice possible were instrumental in increasing rice income for farmer households. For the landless, the greater requirement for labor in harvesting and threshing and the retreat of well-off land reform beneficiaries from farm work led to the increase in hired labor demand in rice farming. The profitability of rice farming had been affected by infrastructure development, importantly, irrigation system and the construction of roads and bridge that enabled farmers to market their rice.

The growth of nonfarm income took place because of the increased availability of jobs in local towns, small cities, big cities, and overseas. Urbanization and globalization are the main underlying forces behind the increasing availability of jobs to the CLV people. The growth of cities surrounding the CLV and globalization through offshoring and outsourcing operations created employment opportunities in the local economy that tend to substitute for jobs in rice farming. The growth of the informal sector within the village was also evident, as shown by the rise in income from non-farm self-employment enterprises. Meanwhile, remittance income rose because overseas jobs became more accessible. Placement fees for overseas jobs declined because of the greater competition among labor recruiters, most of them based in Metro Manila. The improvement of human capital in the CLV also qualified them for overseas jobs, thanks to the construction of village schools that gave full primary schooling and the bridge that connects the CLV to the poblacion where high schools are located and to the cities where colleges are based.

4.2 Decomposition of poverty

In this section, we identify the pathways out of poverty by looking at the poverty indicators and decomposing these according to subgroups of the population. Foster-Greer-Thorbecke [$FGT(a)$] indicators were calculated for the CLV using the PPP $1.25/day poverty[2]. For the years 2004 and 2013, where a more detailed group of households was available, the $FGT(a)$ indicators were also decomposed according to the type of household in order to identify the contributions of the household types to total poverty in the CLV.

The Stata® command devised by Jenkins [2006] additively decomposes each *FGT(a)* index using Equation 1:

$$FGT(a) = \sum_k v_k FGT_k(a) \qquad (1)$$

where $v_k = (N_k / N)$ is the number of households in subgroup k divided by the weighted total number of persons (i.e., subgroup population share), and $FGT_k(a)$ is the $FGT(a)$ indicator for subgroup k. Subgroup decomposition shares (S_k), for each k, are also calculated using the following formula:

$$S_k = v_k \left[\frac{FGT_k(a)}{FGT(a)} \right] \qquad (2)$$

The poverty indices and their corresponding decompositions are presented in Table 10. In 1992, the overall poverty headcount was at 55 percent and this decreased to 50 percent in 2004, only to increase slightly to 52 percent in 2013. In general, a declining trend in the headcount ratio can be observed despite the slight increase in 2013.

The values of the poverty gap index and the squared poverty gap index decreased from 1992 to 2004, but they increased again from 2004 to 2013, eroding the gains from 1992 to 2004. While there have been improvements in reducing the number of poor people in the CLV, the income needed to move the poorest of the poor out of poverty may have increased over time, i.e., the poor have become poorer.

The headcount for farmers has steadily decreased from 48 percent in 1992 to 44 percent in 2004 to 38 percent in 2013. Similarly, the contribution of farmers to overall poverty has been steadily decreasing due to the rise in farmers' income and the declining share of farming households in the population. In 1992, the farmers' contribution to the overall poverty headcount was at 53 percent; it decreased to 30 percent in 2004 and further declined to 20 percent in 2013.

[2] Using the PPP conversion factor in 2005 and the Philippine CPI, the following poverty lines were calculated for the CLV: ₱5175 for 1992, ₱10321 for 2004, and ₱15,539 for 2013. Depending on the value of a, $FGT(a)$ indices are defined as headcount ratio (a=0), poverty gap (a=1), and squared poverty gap (a=2).

As for the change in the relative contribution of non-agricultural households to total poverty headcount in 2004, 29 percent of total non-agricultural workers are poor, contributing 16 percent to the total poverty headcount. In 2013, the contribution of non-agricultural workers to poverty headcount drastically increased to 35 percent. The rapid increase is explained not just by the increase in poverty headcount for non-agricultural workers (46 percent in 2013), but also by the sharp increase in the proportion of households engaged in non-agricultural activities from 27 percent to 40 percent (see Table 2).

TABLE 10. Poverty indicators and its decomposition, 1992-2013

1992	Poverty headcount		Poverty gap		Squared poverty gap	
Overall	55		29		19	
Farmers	48	(53)	23	(47)	14	(46)
Landless	65	(47)	38	(53)	25	(54)

2004	Poverty headcount		Poverty gap		Squared poverty gap	
Overall	50		21		12	
Farmers	44	(30)	18	(30)	10	(29)
Non-agricultural	29	(16)	13	(17)	9	(19)
Daily wage workers	66	(32)	31	(36)	18	(36)
Porcientuhan	71	(22)	23	(17)	11	(15)

2013	Poverty headcount		Poverty gap		Squared poverty gap	
Overall	52		29		20	
Farmers	38	(20)	20	(19)	13	(19)
Non-agricultural	46	(35)	24	(33)	16	(33)
Daily wage workers	74	(24)	47	(28)	33	(29)
Porcientuhan	71	(21)	38	(20)	26	(20)

Note: Numbers in parenthesis are subgroup poverty 'share' of each subgroup.

As for the contribution of daily wage workers to total poverty, the poverty headcount ratio increased from 66 percent to 74 percent, but the share to overall headcount ratio has decreased from 32 percent to 24 percent because of the decrease of the share of daily wage workers in the population. The case of the *porcientuhan* households was different in terms of contribution to total poverty, only slightly decreasing despite having no change in *FGT*(0). It is important to mention that the *porcientuhan* contract offers more remunerative terms and conditions relative to casual daily wage work in rice farming. Thus, it is not surprising that *porcientuhan* workers are economically better off than casual wage workers.

The poverty gap ratio measures the average shortfall of the income of the poor from the poverty line. The poverty gap ratio rose from 2004 to 2013, indicating that the income of the poor went further down from the poverty line. The daily wage worker households have the highest poverty gap ratio, followed by the *porcientuhan* households, while the non-agricultural households have the lowest.

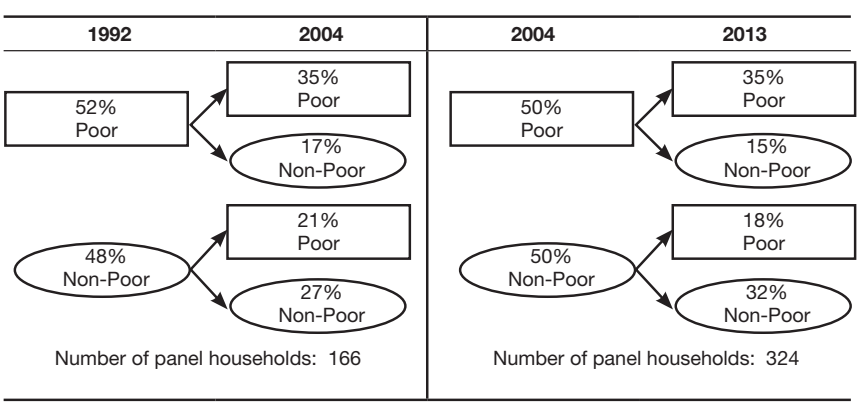
This seems to imply that the poorest of the poor remain in agriculture and that they are the daily wage workers in rice farming. The squared poverty gap ratio measures the inequality of income among the poor and it rose from 2004 to 2013, indicating that the ultra-poor become even poorer in 2013. The highest value of the squared poverty gap ratio was posted by the daily wage worker households, which means that the poorest of the poor indeed belong to this group.

Poverty remains persistent in the CLV in spite of the multifaceted benefits conferred by the modernizing forces. This might be because poor migrants are the ones that settled in the CLV and they provided the additional labor necessary in the booming rice sector. As to whether the benefits of modernizing forces do not trickle down to these poor households need further investigation, although it is clear that these poor new settlers have benefitted from double cropping.

Because the data gathered for the CLV involved complete enumeration of the households, it is possible to create a panel of households from 1992 to 2004 and from 2004 to 2013. Out of the 230 households surveyed in CLV in 1992, 166 were tracked in 2004, whereas out of the 381 households that were surveyed in 2004, 324 were tracked in 2013. Figure 1 illustrates the dynamics of poverty in the CLV for two adjacent survey periods. In 1992, 52 percent of the 166-panel households were considered poor. Of these households, 35 percent remained poor in 2004 (i.e., these households are chronically poor). For the period 2004 to 2013, the chronically poor was close to 35 percent.

In contrast, of those who were non-poor in 1992 (48 percent), 27 percent remained non-poor while the remaining 21 percent fell into poverty. The proportion that fell into poverty in 2004-2013 was 18 percent, which is smaller than the proportion in 1992-2004. Falling into poverty is not a matter of strategy, but a stroke of bad luck (i.e., sickness or death of the major breadwinner, bad harvest, low rice prices, etc.) as nobody would like to fall into poverty. The smaller proportion of those who fell into poverty in the later period is possibly because of favorable rice prices, higher rice yield, double cropping of rice, and more job opportunities in the nonfarm sector.

FIGURE 1. Poverty transition in the Central Luzon Village for adjacent survey years

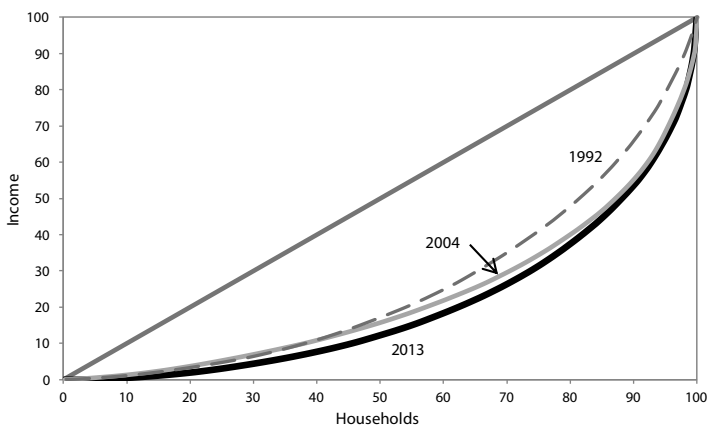


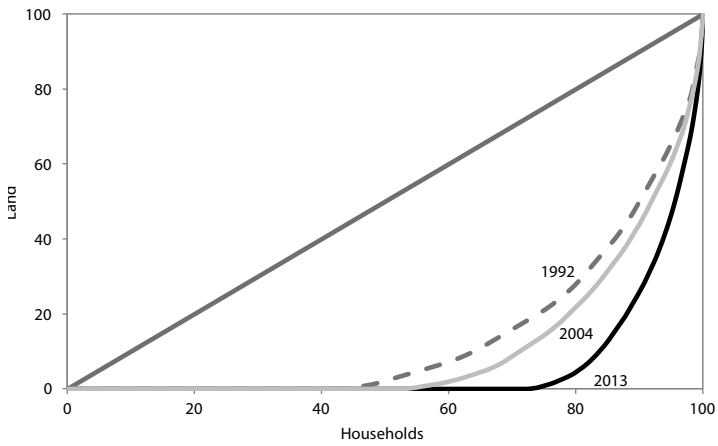
To further support the initial observations from the poverty decomposition, the dynamics of poverty were disaggregated by type of household. Among those who were never poor, farmers and the non-agricultural workers have the two largest shares. They comprise 84 percent of all those who were never poor in 1992-2004 and 91 percent in 2004-13. Similarly, those who moved out of poverty (transient poor) are more likely to be engaged in non-agricultural and farming activities, indicating that rice farming and non-farm activities promote movement out of poverty induced by modern rice technology, infrastructure and telecom development, and improved human capital. Unsurprisingly, a large majority of households who are never poor are farmer households in both 1992-04 and 2004-13, followed by non-agricultural households. Rather unexpectedly, the latter group also comprised a majority of those who fell into poverty in 2004-13 possibly because the nonfarm activities within the CLV are highly heterogeneous and the income derived from these activities rests largely on the economic conditions of the village, which are volatile to seasonal changes in farming.

4.3 Land and income inequality in the CLV

An analysis of the distribution of income and farmland holdings in the CLV may provide insights on which households benefit from the modernizing forces that have been influencing the CLV in the past decades. Figure 2 illustrates the Lorenz curve for income and farmland. For both farmland and income, we see that the distribution of farmland and income in the CLV has always been skewed and has worsened over time. Both Lorenz curves have moved away from the 45-degree line (perfect equality), indicating an increasing trend in inequality from 1992 to 2013. This observation is confirmed by the corresponding Gini coefficients for each Lorenz curve that were calculated and presented in Table 11.

FIGURE 2. Income and land distribution in the Central Luzon Village, 1992-2013





Compared with the income Gini coefficient, the farmland Gini coefficient for 1992 is at 0.7129 representing a high concentration of farmland. The concentration of farmland has continued further in 2004, resulting in an increase in the Gini coefficient to 0.7688. The concentration of farmland has slightly increased in 2013 relative to 2004 mainly because of the increasing scarcity and inequality in access to farmland along with the rapid influx of landless workers. Increased inequality of farmland ownership occurs when some individuals in the CLV have the opportunity to acquire additional parcels of land. Initially starting as a pawned/mortgaged transaction, the original landowners would resort to selling their land/giving up their land rights to the pawnee when owners experience difficulties in repayment. In 2004, the top 10 households with the largest land holdings comprised 28 percent of the total land holdings in that area. In 2013, this proportion further increased to 34 percent. This indicates that fewer households are gaining larger parcels of land while a large number become landless.

TABLE 11. Gini coefficients for land holdings and total income of households in the CLV, 1992-2013

	1992	2004	2013
Income Gini coefficient	0.4842	0.5689	0.6074
95% conf. interval	[0.4482 0.5267]	[0.4998 0.6438]	[0.5636 0.6586]
Land Gini coefficient	0.7129	0.7688	0.8691
95% conf. interval	[0.6458 0.7619]	[0.7329 0.7906]	[0.8394 0.9040]

Migration also has an important impact on the distribution of farmland. As can be seen in the Lorenz curves for farmland (Figure 2, panel B), the proportion of landless members in the CLV has increased sharply. Of the migrant households in 2013, 45 percent were immigrants to the CLV and were engaged in non-farm

work, while 22 percent were immigrants to the CLV and were engaged in daily agricultural wage work. These two groups of migrants represent the largest share of landless households in the CLV.

Relatedly, the influx of migrants to the CLV plays an important role in explaining how non-farm income prevented a drastic deterioration of income distribution in the CLV despite the highly unequal distribution of land. The rapid urbanization occurring within the vicinity of the CLV, as well as the improvements of human capital, has increased the non-farm income-earning opportunities available for landless workers. This weakened the reliance on land as a source of livelihood for most of these households, explaining the slower pace of increase of income inequality compared with farmland inequality.

A decomposition of the Gini coefficient by sources of income (Table 12) was conducted to quantify the relative importance of various income components to overall income inequality. Following the procedure used by Otsuka, Cordova and David [1992] and Feldman [2006], the total income Gini for each year was decomposed into its income components using the formula:

$$G = \sum_i S_i R(y, x_i) G(x_i) \qquad (3)$$

where G is the Gini coefficient of total income, $G(x_i)$ is the Gini coefficient for the income from the ith source, S_i is the share of ith source, and $R(y, x_i)$ is the rank correlation. Intuitively, Equation 3 explains the total income inequality, G, as influenced by the relative importance of the income source to the total income, S_i, the distribution of income of source $G(x_i)$ and the relationship between the two, $R(y, x_i)$. Table 12 not only provides the share of the income source to total inequality but also provides the percentage change in inequality induced by a small change in income source.

TABLE 12. Decomposition of total income, by income source

Source	1992			2004			2013		
	Gini	Share	% change	Gini	Share	% change	Gini	Share	% change
Farm income									
Wage	0.6868	1	-0.1298				0.7635	0	-0.0747
Rice	0.7598	29	0.0201	0.8665	8	-0.0013	0.9244	15	0.0231
Other crops	0.8536	5	-0.0083	0.847	8	-0.0001	0.9734	0	-0.0057
Livestock	0.7913	4	-0.0155				0.9788	5	0.0102
Non-farm income				0.5692	62	-0.0376			
Non-farm wage	0.8811	25	0.0657				0.7871	29	-0.0138
Non-farm enterprises	0.8563	16	0.0071				0.9325	10	0.0068
Remittances	0.9366	20	0.0607	0.7902	22	0.039	0.8323	41	0.0541
Total income	0.4842	100		0.5689	100		0.6074	100	

Consistently, across the years, rice income, non-farm income (nonfarm wage and non-farm enterprise), and remittances have the largest shares contributing to total income inequality. Over time, there was a shift in the inequality-reducing sources of income. In 1992, all of the inequality-reducing income sources were related to agriculture (i.e., wage, crop, and livestock). For 2004, non-farm income as a whole reduced inequality. For 2013, farm wages and non-rice production were inequality-reducing sources of farm income, while non-farm wages were inequality-reducing sources of non-farm income. Across the years, the percentage change in the Gini coefficient of total income from a small change in remittances has been increasing, implying that remittances have consistently been inequality-increasing. Overall, the decomposition supports the importance of agricultural wages and non-farm wages as inequality-reducing sources of income, attesting to the rising importance of labor and human capital as a source of household income.

5. Summary and conclusions

The spread of modern rice technology and the infringement of forces of modernization at the core of livelihood of rural Filipino households are suspected to be major causes of impoverishment. This paper is an exploration into the paths of development of a typical rice-growing village in Central Luzon (called the CLV) where new rice technology was successfully adopted and where four forces of modernization have evolved, causing socioeconomic changes in this village. The four forces of modernization are (1) population pressure on the closed land frontier; (2) implementation of land reform; (3) expansion of public infrastructures such as irrigation systems, roads, and schools; and (4) growing urban influences accelerated by improvements in transportation and telecommunication systems.

The main finding is that the interaction between the new rice technology and forces of modernization did not necessarily lead to impoverishment and destitution. On the contrary, evidence from the CLV shows a remarkable increase in household income and no increase in poverty, although income distribution has deteriorated because of the deterioration in farmland distribution and, more decisively, by the influx of poor migrants to the CLV who were attracted by the increase in employment opportunities in rice farming due to the expansion of the irrigation system.

In terms of population pressure, it was found that the man-land ratio has increased over time, indicating a strong population pressure on the closed land frontier. The implementation of land reform led to a major shift in land tenure away from share tenancy (which is prohibited by law) in favor of leasehold tenancy and ownership. Because of the prohibition of share tenancy, a new system of land tenure in the form of mortgaging (or land pawning) has evolved because of the rise in the transaction value of leasehold land. A new form of labor contract called *porcientuhan* became popular when the CLV started to have access to irrigation beginning with deep water pump irrigation and then with the

gravity irrigation system of CASECNAN. The forces of urbanization, manifested in the rise of small cities and the expansion of big cities near the CLV, have started to be felt in the CLV as households who are more dependent on non-farm income (such as the non-agricultural households, farm daily wage workers, and *porcientuhan* workers) tend to live in that part of the CLV that is more accessible to the urban areas. Infrastructure has developed, including market infrastructure (roads and bridges) and, more recently, the irrigation system for rice farms. The human capital of households in the CLV sharply improved, giving villagers better opportunities to access jobs in the booming non-farm sector.

These catalysts of change have affected the sources of income of households in the CLV. Rice income–which has been traditionally a major source of income for farmers–has been replaced by non-farm income. For landless workers, the share of agricultural wage work has been declining, while those of remittances and non-farm wage income have become more important. Both farming and landless households (the poorest in the village) have experienced remarkable improvement in income. This is due to the increase in income from the rice sector due to the development of irrigation, which allowed double-cropping, and because of the increase in income from nonfarm work.

Poverty headcount index has declined over time in the CLV as a whole. Headcount ratio was highest among daily wage workers and *porcientuhan* workers. Farming households and non-agricultural households comprised a substantial portion of households that were never poor and poor households in these groups are more likely to move out of poverty. It attests to the importance of having farmland and being engaged in non-agricultural work as these are important "safety ropes" to move out of poverty.

The modernizing forces also redefined the sources of income inequality. Household incomes that promote equality are agricultural wage and high-value products (or high-value revolution), whereas inequality-promoting are nonfarm enterprises and remittances. Migration to the CLV has increased inequality of land distribution, but the availability of employment opportunities in farm and nonfarm wage work brought about by urbanization and improvement of infrastructure and better human capital prevented a drastic deterioration of income distribution. In the end, land distribution no longer dictates the distribution of income in this village.

To sum up, this village has demonstrated that, contrary to existing belief, the interaction between the new rice technology and the four forces of modernization has, in fact, conferred benefits to a large majority of the villagers. The main pathway is the creation of employment opportunities in rice farming and in the non-farm sector within and outside the village. Since non-farm income is now the main source of income, it seems reasonable to conclude that human capital has become more important than farmland in the pursuit of a livelihood.

Acknowledgements: This work was supported by the Japan Society for the Promotion of Science (JSPS), KAKENHI Grant number JP25101002. The authors would like to thank the two anonymous referees of this journal for their comments on an earlier draft of the manuscript. The usual caveat applies.

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The Philippine Review of Economics
57(1): 71-100. DOI: 10.37907/4ERP0202J

By his words alone: the economic consequences of Rodrigo Duterte

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Philippine President Rodrigo Duterte has gained worldwide notoriety for his foul-mouthed statements, particularly for his threats directed towards the nation's largest businesses and their powerful owners. Such pronouncements, which may be mistaken for shifts in government policy, may inadvertently provoke the business sector to react negatively. This paper examines whether President Duterte's negative business-related pronouncements have an appreciable effect on the Philippine Stock Exchange Index (PSEi). We apply an interrupted time series model on PSEi data for the period June 30, 2016 until December 31, 2019 to determine Duterte's impact on stock prices under six different intervention scenarios. Specifically, we test different classifications of business pronouncements—initial business pronouncements, anti-oligarch statements, personal attacks, and combinations of the three. The results show a significant relationship between Duterte's negative business-related pronouncements on the PSEi closing price, with the biggest changes occurring during the first times he brought up a particular issue or addressed a certain personality. We aggregated the losses for the period 2018-2019 resulting from these pronouncements. For the five pronouncements, we estimate the combined losses to rise from ₱1 million on the day they were made to ₱47 million within five days and, as the market continues to adjust, up to ₱441 million within ten days.

JEL classification: C23, G12, G14, G41
Keywords: political communication, stock markets, efficient market hypothesis, event studies

1. Introduction

History has borne witness to the catastrophic consequences of concentrated power. Even when extensive decision-making capabilities are democratically

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accorded to a single person, the potential for disastrous consequences compels the average citizen to stand watch and demand accountability. There is a long-standing tradition among scholars and pundits to scrutinize the actions of such leaders. In his famous essay "The economic consequence of Mr. Churchill", John Maynard Keynes criticized then Britain's Chancellor of the Exchequer for his decision to return Britain to the gold standard [Keynes 1925]. While Winston Churchill went on to become Britain's Prime Minister for two terms, Keynes, remained vigilant in critiquing Churchill's policies until his death in 1946 [Arndt 2011].

The past few years have witnessed the rise of populist strongmen democratically elected to highest state positions—most notably Donald Trump in the United States, Jair Bolsonario in Brazil, and Rodrigo Duterte in the Philippines. Since then, these personalities consistently dominate international news headlines for what seems to be a penchant for swift, illiberal patterns of decision making and tactless, foul-mouthed statements that have shocked markets worldwide. In this study, we echo Keyne's warning bells by looking into Rodrigo Duterte's presidency to examine for tangible economic consequences of some of his seemingly inconsequential words.

Ever since his election in 2016, President Duterte has gained notoriety locally and internationally, not least for peppering his speeches with curses and crass statements in attempts to assert, ridicule, and make a point. Most notably, he has made statements that are directly anti-investor and anti-business, with seemingly little regard for their potential adverse economic effects. Many times he threatened to shut down a major broadcasting corporation (and has since succeeded) and to rescind the long-standing government contract of a private water utility company. He has directed his ire to some of the country's top business oligarchs such as the Ayalas, Ongpins and Manny Pangilinan. Insofar as such pronouncements fuel doubts about the stability of government regulations or contractual commitments, they potentially harm the business and financial sectors and could deter local and foreign investors from participating in the domestic stock market.

The importance of a healthy stock market to a country cannot be discounted. Levine and Zervos [1991] along with Bencivenga et al. [1995] find it a possible avenue towards growth, as the act of distributing company ownership shares fosters an efficient allocation of resources and the ability to pursue long-term projects. Greenwood and Smith [1997] also note that a well-developed stock market, by reducing the cost of mobilizing savings, can lead to an increase in the country's level of investments.

To date, the relevant research on the Philippine stock market is sparse. Among the few, Tang et al. [2007] find empirical evidence of the tendency of Philippine stock market indices and growth indicators to move together in the long run. As an emerging market, the Philippine financial sector is reportedly more susceptible to external shocks (Guigindo [2009]; Sy and Hofilena [2014]). Given these observations, one would assume a well-minded government chief executive would avoid dangerous rhetorics so as not to incite the financial market or provoke a sudden outflow of short-term capital.

Time and again, President Duterte has claimed that his cursing is "not a crime". He and his numerous spokepersons have made light of his past statements as jokes, and even offered the excuse that his outbursts were merely a manner of self-expression. Activists, religious leaders, and even international media have brought to wider attention the offensiveness of his slurs, and called his verbal slights conduct unbecoming of his exalted position. While these protests were provoked by the political and moral implications of Duterte's elocution, do his words also have an economic effect? Do they have an adverse consequence on the country's wealth?

In this study, we examine whether or not President Duterte's business-related pronouncements have had appreciable effects on the Philippine Stock Exchange Index (PSEi). We first tracked and classified his daily pronouncements in 2018 and 2019 and then, using interrupted time series model, tested for their effects on stock prices. Consistently across six different ways we classified his pronouncements, we find a statistically significant relationship between Duterte's negative business-related statements and the PSEi closing prices, especially on the days he first brought up a particular issue. We also estimated the resulting aggregate wealth losses in 2018 and 2019.

2. Review of related literature

The relationship of political communication to investor sentiment, and how it eventually contributes to stock price fluctuations is a relatively new topic in financial economics. The extant relevant literature is therefore limited. However, interest has started to grow in recent years following the election of strongmen around the world. Unlike typical high-ranking politicians who are often diplomatic and refined in their public demeanor, these strongmen can at times appear brash and uncouth. Commanding enormous political, military and fiscal powers, these strongmen can make pronouncements that many will inadvertently take as signals of impending changes in government policies.

This review will first delve into the theory and evidence of the efficient market hypothesis, and how its predictions have been validated for all sorts of shocks. We then review the evidence of how the stock market reacts to political events, with a focus on political communication, political news, and media coverage of the stock market.

2.1. The Efficient Market Hypothesis

The efficient market hypothesis is a theory in financial economics that states how asset prices immediately reflect all available information, thereby making a market efficient [Fama 1970]. This means that it would be impossible for an investor to predict future prices by examining previous ones, as it is assumed that the market has already incorporated all relevant information [Fama 1991].

Although the extensive empirical evidence on the efficient market hypothesis has been mixed, it has no rival hypothesis that is at least equally successful.

Fama's [1970] classification of semi-strong market efficiency pertains to how present stock prices represent both historical and recent information. This would imply short-term fluctuations in the market arise after an unanticipated event, which are information shocks that can be exploited as potential short-run arbitrage opportunities that allow market players to recalibrate their investment decisions. Due to its nature of daily trading, the stock market has been used historically to measure short-term reactions to information shocks. In this market, investors can quickly readjust their portfolios following the release of new critical information [Titan 2015].

In his analysis of the Philippine stock market for the period 1998-2014, Aquino [2006] has found that PSEi displayed weak-form efficiency, but incorporated information immediately. Chen and Diaz [2014] contend that PSEi reactions have relatively improved in terms of market efficiency after the 2008 Global Financial Crisis.

2.2. Political communication and asset pricing

Research interest on the relationship of political communication (especially those relating to a country's head of state) to asset prices is relatively recent. The available empirical findings on the topic are still limited. Most studies explore the effects of US President Donald Trump's tweets on the US stock market, which gained prominence in mainstream media after Bloomberg News created the *Volfefe Index* to measure abnormal returns on US Treasury Bonds every time the president tweeted [Alloway 2019]. Born et al. [2018], in assuming the efficient market hypothesis, found that the stock prices of publicly traded firms had a positive (negative) reaction to Trump's positive (negative) tweets in the short-term.

Moreover, Xun's [2017] work finds that, historically, presidential candidate speeches have demonstrated the capability to affect investor expectations, particularly in response to government-spending information. Tilmann's [2020] study analyzes all of Trump's avenues of communication pertaining to the Federal Reserve and showed that these statements seemed to affect long-run interest rates.

2.3. Media coverage and asset pricing

Media coverage plays the role of distributing relevant information and decreasing information asymmetries among corporations, governments and investors. Studies that examined the relationship between media coverage and stock returns report mixed evidence. Yang et al.'s [2019] findings in China suggest that companies that garner higher media attention tend to obtain higher sustainable stock returns; meanwhile, Fang and Peress [2009] disagree, and write that firms that receive fewer media coverage tend to expect higher returns than those that do in the United States. A recent analysis on media coverage, however,

has been more qualitative than quantitative; for example, Wu and Lin [2017] utilize textual analysis to assess the relationship of stock price fluctuations and how media is covered. They find that news that is positively (negatively) framed by the media tends to increase (decrease) stock trading volume.

Moreover, it has been noted that online and social media have increasingly influenced investor sentiment, while traditional news media has relatively less impact on stock market volatility [Jiao et al. 2018].

2.4. Political news and asset pricing

There is more supporting empirical evidence of the relationship between political news and the stock market, starting with Niederhoffer's [1971] proof of the relationship between stock market returns and headline news from two major US publications. In the case of emerging markets, Onder and Simga-Mugan's [2006] research in Argentina and Turkey finds that news undoubtedly affects stock price fluctuations in varying degrees. Suleman [2012] tests the relationship of news on political risk to the Karachi Stock Exchange and finds evidence that good information positively affects the Karachi Stock Exchange Index, and vice-versa. Bad news also poses a stronger effect on volatility than good news. Meanwhile, Zach's [2013] research testing the Israeli Stock Exchange shows that stock market returns vary more after political events than after trading days that had none.

3. Conceptual framework

In formulating our hypothesis, we employ Pastor and Veronesi's [2013] theoretical model for evaluating the relationship between political uncertainty and risk premia. According to their model, stock prices are predominantly affected by three types of shocks, which include "political shocks". Political shocks refer to political news that lead investors to assume potential policy changes and their implications, and then act on the news by adjusting their portfolios accordingly. The model assumes the political shocks are unrelated to economic ones, and as such, they induce investors to demand a compensation for the extra risks resulting from exclusively political events. The resulting "political risk premium" incorporated in asset prices are then the direct economic outcomes of such political events.

Further, Pastor and Veronesi [2013] contend that these so-called political risk premiums are context-dependent. While there would be a higher political risk premium demanded when there is more political uncertainty, clear political signals (e.g., if the president expresses plans to close down a major business) could also induce a negative reaction from investors. In general, stable economic conditions supported by a strong, predictable policy regime would reassure investors and thus lead to small political risk premium. Meanwhile, mixed political signals

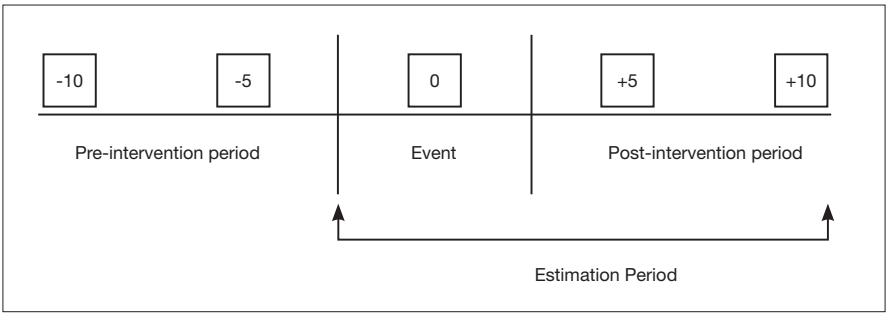
along with abrupt and drastic policy changes and weak economic conditions would discourage investors and thus lead to high political risk premium.

The available empirical evidence generally support the implications of Pastor and Veronesi's [2013] model. Kelly et al. [2014], in examining the effects of the political risk premium on expected events such as national elections, discover that options are generally priced more expensive the longer they live through different political events. Gao et al. [2012] find that risk premiums in the bond market are higher during recessions and close elections, and lower for states with restrictions on budget balances and financial disclosure.

Our framework also builds on Fama's [1970] semi-strong form of efficiency which assumes that stock prices instantaneously incorporate all historical and publicly available information. Investors adjust their portfolios in response to unanticipated events that can affect the market.

We consider Duterte's pronouncement as an unanticipated event and attempt to measure its repercussions (if any). To systematically do so, we employ an event study framework (Figure 1) that isolates the event, along with its pre- and post-intervention period. An unanticipated event is expected to disrupt the trend experienced by the market during the pre-intervention period and cause an anomaly that is manifested after the event happens. Isolating the event allows us to differentiate its effects from the market's general movement, and other factors that routinely cause its fluctuations.

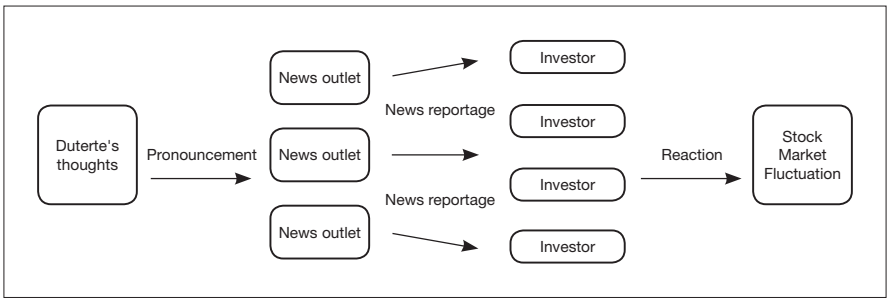
FIGURE 1. Event study framework



We keep in mind that Duterte's pronouncements undergo a process of information dissemination before it reaches investors. Figure 2 illustrates how Duterte's thoughts or ideas eventually affect asset prices. When the president expresses his ideas verbally, reporters and media outlets cover the event and often report his pronouncements as headline news. In doing so, they filter his speeches, consciously or not, through various methods. These may include highlighting some of the President's words or phrases, or topics and issues, or excluding some information they deemed unnecessary, or narrating the occasion that casts the president in a positive or negative light. Consequently, investors will receive the

news from different sources with their own slants and interpretations of the same event. Some investors will react negatively, others positively, and maybe a few will do nothing with their existing portfolios. In general, though, the stock market can be expected to be perturbed, and the stock prices can be expected to change. When that happens, a causal relationship between Duterte's pronouncements and the stock market can be said to exist.

FIGURE 2. Information transmission process



To justify the investor's seeming overreaction to political news, we draw from the burgeoning research in behavioral finance. This new field in financial economics builds on the key insights of Kahneman and Tversky's [1979] prospect theory, among others. According to this theory, people are more averse to losses than they like gains. When applied in finance, the theory implies that real-world investors are not like the perfectly rational, utility maximizers assumed in the efficient market hypothesis, but rather decision makers with emotional tendencies and cognition limitations. In the present study, we take it that the investors' reactions to unanticipated political events are driven by their loss-aversion and desire to obtain higher returns.

Moreover, pronouncements carry signals that depend not just on the message, but also on language expression and word use [Xun 2017]. Emotional outbursts, curses, and outright attacks on major businesses incite worries and could signal instability. Of course, language and expression are subjective phenomena that cannot be easily quantified; this study does not measure the emotion imbibed in Duterte’s speeches. Nonetheless, we keep in mind that his strong outbursts and threats can possibly upend investors' already fragile sentiments, and that would manifest as wider market fluctuations.

The main hypothesis to be tested here is that President Duterte's negative or adversarial pronouncements against business have an immediate negative impact on the Philippine stock market (as proxied by the Philippine Stock Exchange Index).

4. Methodology

4.1. Data

4.1.1. Philippine Stock Exchange Index

The PSEi, otherwise known as the Philippine Stock Exchange Index, is an index composed of the top 30 common stocks in the national market. PSEi daily data was sourced online from Yahoo Finance, as it features daily stock data worldwide spanning several years [Yahoo Finance 2019].

4.1.2. Duterte's business-related pronouncements

We collected information about Duterte's daily pronouncements for the period starting from his inauguration on 30 June 2016 until 31 December 2019. We did this initially through a combination of Google searches on notable keywords (i.e. "Duterte [date]"), and then cross-checked the reported news about Duterte against the available information in the websites of selected top news agencies. We adopt the following selection criteria: First, the pronouncement must have been specifically quoted and made into headlines. We therefore assume business players are more concerned with headline news than less prominent ones. Second, we only recorded whether or not Duterte made a negative business-related pronouncement regardless of the number of times he has spoken of the same or different topic on the same day.

The dates of these pronouncements were chosen selectively, but we made sure to test an almost equal number of statements for each year of Duterte's term to gain a general sampling of the effects within his administration. Pronouncements were also chosen based on their classification, guaranteeing a similar number of statements tested per category and per iteration.

Pronouncement data were collected online from major news outlets, namely Rappler, ABS-CBN News, GMA News, Inquirer.net, The Philippine Star, BusinessWorld, and The Manila Bulletin. Online news sites are assumed to be a source of information for active investors within the country. To corroborate this partially, we cite the results of a survey conducted in 2019 by the Social Weather Stations, to wit: around 21 percent of adult Filipinos (roughly 14 million) consume news mainly through Facebook.

4.1.3. Monetary and price variables

Aside from Duterte's pronouncements, the Philippine stock market is also influenced by the domestic monetary policy, inflation rate and global interest rates. To account for the direct effects of these factors, we introduce proxy indicators in the estimation model. To proxy for monetary policy, we use the daily reverse

repurchase rate (*Reverse Repurchase Rate*) of the Bangko Sentral ng Pilipinas (BSP). It is the predetermined rate at which the BSP borrows from banks with government securities as collateral and is an open market operation that the BSP primarily uses to control the money supply. Monetary policy is incorporated in the estimation model since when the BSP contracts the money supply it is often followed by a higher discount rate and lower expected returns. These in turn alter investor expectations and tend to deflate stock prices.

There is some empirical evidence of the significant relationship between money supply and stock prices [Bordo and Wheelock 2007]. In the Philippine context, Sy and Holifena [2014] find that an announcement of contractionary monetary policy decreases the PSEi index sharply in the short-term before the effect starts to taper off. They attribute the resulting stock market losses to the economic uncertainties induced by speculations about monetary policy, and the demonstrated sensitivity of Filipino investors to movements in policy rates.

Also obtained from the BSP, the daily inflation rate (*Inflation Rate*) is included since inflation reduces the purchasing power of investment returns. So, a rising inflation will discourage investments. When the BSP is unable to curve excessive inflation, this can also foster economic uncertainty.

Fama [1981] finds a significant positive relationship between inflation and stock market pricing in the United States, while Sathyanarayana and Gargesa [2018] report similar in seven out of 13 countries they assessed.

Since financial markets are globally integrated, global interest rates will also matter to the level and movement of domestic stock prices. We use daily US interest rates as a proxy (labelled as *Global Interest Rate*) and collect the information from the BSP. Sy and Holifena [2014] find that the Philippines market is sensitive to exogenous shocks. The BSP's inflation-targeting scheme also takes into consideration the US Federal Reserve's interest rate hikes and cuts to avoid excessive capital inflows and outflows [Tetangco 2014].

4.2. Interrupted time series model

In testing the effect of Duterte's pronouncements on stock prices, we examine for implications of the efficient market hypothesis: that is, unanticipated events such as Duterte's outbursts have a short-run effect on the market.

We examine our data using the interrupted time series analysis (ITSA) model, which is specifically designed to estimate the effects of exogenous interventions in a time-series framework. In applying the ITSA model, we considered six intervention scenarios and a single group of participants. Effectively, this group comprises all market players in the Philippine Stock Exchange during the period June 31, 2016 to December 31, 2019. We abstract from the fact that the size and composition of market participants may have changed during the period.

Following the exposition in Linden [2015], we estimate an equation of the following form:

$$Y_t = \beta_0 + \beta_1 T_t + \beta_2 X_t + \beta_3 X_t T_t + \boldsymbol{Z}_t \boldsymbol{\gamma} + \varepsilon_t \qquad (1)$$

where Y_t is the value of the dependent variable in time t, T_t is the length of time since the start of the study up to t, X_t is the intervention indicator, $\boldsymbol{Z}_t$ is a vector of control variables, β_0, β_1, β_2, β_3 and $\boldsymbol{\gamma}$ are parameters to be estimated, and ε_t is the error term. In our empirical implementation, the dependent variable is the closing price of the PSEi (or *PSEi close*), and X is a dummy indicator that is equal to 0 for all times before the intervention and 1 beginning the time of the intervention and thereafter. In the above equation, the starting level of *PSEi close* is represented by the intercept (β_0), the trends of the *PSEi close* before and after the intervention represented by the slopes β_1 and β_2, respectively, and the difference in the preintervention and postintervention trends is captured by β_3, Thus, the key parameters of interest are the estimates of β_2 and β_3, which capture the intervention's immediate and long-term effects, respectively. In this paper, an intervention is operationally defined as a particular business pronouncement of President Duterte.

4.3. Period of analysis and intervention scenarios

Our period of analysis starts from June 30, 2016 up to December 31, 2019. This period starts on the day Rodrigo Duterte was sworn to office until the end of 2019. The dataset contains 907 observations, which include only the formal stock trading days and exclude weekends and national holidays. Since Duterte's statements and stock prices are dated only for business calendar days, we transform them into a daily series by deleting the gaps due to weekends and holidays and thus make them amenable for time series analysis.

Applying the ITSA model to the data, we test for the effects of Duterte's business pronouncements under six intervention scenarios. Under each scenario, we estimate the effect on the changes in the PSEi closing prices. Table 1 shows the list of pronouncements.

TABLE 1. Pronouncements and Dates used in the study

Date	Intervention Scenarios	Subject of Pronouncement Made	Direct Quote
August 1, 2016	Scenario 2 and 6	Duterte's anti-oligarch sentiments	"Oligarchs…. get rich at the expense of our native land." [GOVPH 2016].
			"Destroy the oligarchs that are embedded in government. I'll give you an example, publicly – Ongpin, Roberto" [Ranada 2016]
August 3, 2016	Scenario 1, 3, and 4	Duterte calls out Roberto Ongpin as an oligarch	"Destroy the oligarchs that are embedded in government. I'll give you an example, publicly—Ongpin, Roberto" [Ranada 2016]
March 30, 2017	Scenario 3, 5 and 6	Duterte tells 'rude' media: Beware of 'karma'	"You stink, you Prietos, Lopezes. You're full of shit." [Ranada, 2017]
September 27, 2017	Scenario 3	Duterte to Lucio Tan: Pay PAL arrears	"Bayaran mo. Pag hindi mo bayaran, eh di sarhan ko.' Wala nang airport. So what?" [Corrales, 2017]
August 3, 2018	Scenario 2 & 5	Duterte threatens ABS-CBN franchise renewal	"But if I had my way, I would not give it [the franchise] back to you," [Ranada, 2018]
April 17, 2019	Scenario 1, 2 & 4	Duterte threatens Manila Water and Maynilad over price hike Duterte	"Why do you have to cause problem for the people when there are things that you can do at once" [CNN PH, 2019]
October 28, 2019	Scenario 1	Duterte slams Lopez group anew for past DBP loans	"The Lopez Group of Companies never paid a single centavo." [ABS-CBN News, 2019]
September 18, 2019	Scenario 1, 3, & 5	Duterte warns of 'takeover' amid looming water crisis	"I will go and operate it myself. I will take over and I will direct what to do." [Ranada, 2019]
December 3, 2019	Scenario 2	Duterte on ABS Franchise Renewal	"Ang inyong franchise mag-end next year [Your franchise will end next year]. If you are expecting na ma-renew 'yan [a renewal], I'm sorry. You're out." [CNN PH, 2019]

The six intervention scenarios are as follows:

- Initial Pronouncement
  This scenario considers the negative business pronouncements that are directed to the business sector at large. The test therefore allows us to examine how the President's negative remark about the business sector can impact the stock market.
- Against Oligarch
  This scenario shows the effects of Duterte's pronouncements that are considered here as "anti-oligarch". His "anti-oligarch" statements are based on instances when he specifically referred to some business owners or big business companies as "oligarchs", or when he singled out particular industries dominated by a few players (such as water utilities and broadcasting).

- Personal Attack
  This intervention scenario shows the effects of Duterte's pronouncements that are considered here as "personal attacks". For this study, personal attacks refer to Duterte's statements that either mention the names of the business leaders or talk about them negatively. The business leaders he has famously named in his tirades include Roberto Ongpin, Lucio Tan, the Prieto family, and the Lopez family.
- Interaction Scenarios
  To test whether a combination of Duterte's pronouncement would also have effects, we examine three "interaction" scenarios, namely: interactions between initial business pronouncements and statements against oligarchs, between initial business pronouncements and personal attacks, and between those made against oligarchs and personal attacks.

4.4. Regression variables

The names, definitions, and summary statistics of our variables are shown in Table 2. Corresponding to the six interventions scenarios mentioned above, the table includes six dummy variables, namely: *Initial Pronouncement, Anti-Oligarch, Personal Attack, Initial Pronouncement & Anti-Oligarch Interaction, Initial Pronouncement & Personal Attack Interaction,* and *Anti-Oligarch & Personal Attack Interaction.* The list also includes lagged values, namely: *Lagged_Anti-Oligarch, and Lagged_Personal Attack.* The other indicators are *Reverse Repurchase Rate* (for BSP's reverse repurchase rate), *Inflation Rate* (for daily inflation rate), and *Global Interest Rate* (for the US daily interest rate).

TABLE 2. Summary statistics of the regression variables

Variable	Observations	Mean	Std. Deviation	Minimum	Maximum
PSEi close	902	7785.378	434.6617	6563.67	9058.62
PSEi close detrended	902	7785.443	425.6489	6696.965	8946.499
Initial Pronouncement	902	0.0321508	0.1764983	0	1
Anti-Oligarch	902	0.0266075	0.1610227	0	1
Personal Attack	902	0.0088692	0.0938098	0	1
Reverse Repurchase Rate	902	3.59867	0.7083562	3	4.75
Inflation Rate	902	3.270621	1.536168	0.8	6.7
Global Interest Rate	902	4.5902	0.6785543	3.5	5.5
Lagged_Anti-Oligarch	902	0.0266075	0.1610227	0	1
Lagged_Personal Attack	902	0.0088692	0.0938098	0	1
Initial Pronouncement & Anti-Oligarch Interaction	902	0.0266075	0.1610227	0	1
Initial Pronouncement & Personal Attack Interaction	902	0.0088692	0.0938098	0	1
Anti-Oligarch & Personal Attack Interaction	902	0.0088692	0.0938098	0	1

4.5. Estimation issues

We detrend our dependent variable *PSEi_close* to rid it of extreme values and other unrelated trends in the data. *PSEi_close* is detrended through the computation of a simple moving average over the period of two trading weeks or ten days. The calculations are done in STATA using Interrupted Time Series Analysis (ITSA) and *Posttrend* was used to determine the effects and price trend estimates following Duterte's statements. We perform the Cumby-Huizinga test to examine for serial correlation in the time series, particularly among lagged values. The *varsoc* command through the lowest Akaike information criterion was used to determine the optimal-lag order selection. Due to the detrending and that some variables are lagged, the estimation sample is reduced to 902 observations.

5. Analysis of results

In this section, we discuss the test results that indicate the impact of President Duterte's business pronouncements on the stock market through the changes in the PSEi closing prices. We test 12 iterations in total: six separate intervention scenarios and their detrended versions. All 12 tests include the same control variables.

Scenario 1: Initial Business Pronouncements

Table 3 shows the results of Duterte's initial business pronouncements between August 2016 and April 2019. On August 3, 2016, the results show a stark decrease post-intervention of 586 points, as well as a decrease of 0.56 point overall as a trend post-intervention. The results show similar magnitudes in regression values for detrended prices. Overall, we can see that a negative business pronouncement by Duterte has significant and negative effects on stock prices immediately after a single intervention. The initial pronouncement dummy in both iterations (using close and detrended close) is shown to be insignificant in the regression.

On October 28, 2019, Duterte's statement led to an increase of 571 points. There is also a relative increase of 10 points compared to the former price trend and an increase post-intervention of 7.68 points. The results using detrended PSEi close show similar magnitudes. The initial pronouncement dummy, in this case, is significant in the detrended iteration.

On September 18, 2019, there is a 292-point decrease after the intervention, and a relative decrease of 14.44 points compared to the former price trend. The post-intervention trend, in this case, is insignificant, but significant in the detrended version. There is a very small difference with the detrended values. For both PSEi close and its detrended version, the initial dummy pronouncement is insignificant.

On April 17, 2019, the pre-intervention trend, post-intervention trend, and the difference between them are insignificant in this iteration. After the intervention, we see an instant decrease of 366 points. The results of the detrended iteration show that the trends are significant. The initial pronouncement dummy remains insignificant in both iterations of this test.

TABLE 3. Scenario 1: Initial pronouncement regression results

	August 3, 2016		October 28, 2019		September 18, 2019		April 17, 2019	
Variables	PSEi close	PSEi close detrended	PSEi close	PSEi close detrended	PSEi close	PSEi close detrended	PSEi close	PSEi close detrended
Initial Pronouncement	-54.21	-74.56	-90.44	-102.19**	-61.47	-70	-3.61	-9.08
	(54.39)	(53.91)	(51.76)	(51.25)	(51.01)	(51.11)	(58.78)	(58.12)
Reverse Repurchase Rate	-747.83***	-745.80***	-775.00***	-771.05***	-767.20***	-760.37***	-687.43***	-681.86***
	(64.58)	(61.49)	(64.6)	(61.47)	(64.39)	(61.02)	(61.45)	(57.78)
Inflation Rate	-173.08***	-164.89***	-217.81***	-201.99***	-215.85***	-197.85***	-234.08***	-227.79***
	(13.24)	(12.95)	(16.07)	(15.83)	(16.09)	(15.76)	(17.53)	(17.23)
Global Interest Rate	1160.39***	1092.31***	1711.48***	1557.93***	1601.03***	1374.05***	813.49***	419.40*
	(91.36)	(82.7)	(135.71)	(127.81)	(164.55)	(160.75)	(254.86)	(249.6)
Pre-Intervention Trend	13.87***	18.27***	-2.06***	-1.68***	-1.75***	-1.56***	0.77	1.99***
	(2.08)	(1.83)	(0.25)	(0.25)	(0.36)	(0.38)	(0.75)	(0.76)
Immediate Effect	-586.06***	-577.83***	571.61***	398.72***	-292.92***	-340.92***	-366.46***	-318.22***
	(60.17)	(57.08)	(115.51)	(113.72)	(84.28)	(94.15)	(67.24)	(61.59)
Difference (Pre- and Post-Intervention Trends)	-14.44***	-18.69***	9.74***	6.57***	16.10***	13.26***	-2.4	-5.54**
	(2.08)	(1.82)	(3.12)	(3)	(2.07)	(2.06)	(2.09)	(2.08)
Post-Intervention Trend	-0.56***	-0.42***	7.68**	8.25***	14.35	12.10***	-1.62	-3.55***
	(0.16)	(0.14)	(3.05)	(3.06)	(1.81)	(1.8)	(1.38)	(1.34)
Constant	6186.77***	6453.40***	4326.74***	4782.72***	4669.81***	5361.65***	7061.97***	8341.51***
	(218.32)	(196.24)	(349.47)	(338.6)	(461.45)	(467.54)	(801.52)	(798.59)
F-statistic	59.84	92.48	46.77	49.13	48.4	49.05	43.84	48.71
Prob>*F*	0	0	0	0	0	0	0	0

***significant at the 1-percent level, **significant at the 5-percent level, *significant at the 10-percent level
Figures in parenthesis are standard errors.

Scenario 2: Anti-Oligarch Statements

The results of Duterte's statements against oligarchs between August 2016 and December 2019 are presented in Table 4. On August 1, 2016, the results show a decrease of 560 points after the intervention, as well as a decrease of 0.58 point overall as a trend post-intervention. This results in a relative decrease of 15.19 points compared to the former price trend. The detrended values exhibit similar results.

On October 3, 2018, we see an immediate price decrease of 188.40 points, followed by an overall decrease in the price trend of 3.90 points daily. The same results are found using detrended prices, only differing slightly in value but identical in terms of significance.

On April 17, 2019, both post- and pre-intervention trends, as well as their difference produce insignificant results. Despite this, post-Duterte's statement, there is a price decrease of 366.72 points. Using detrended PSEi prices, all the trend-related variables become significant. The control variables are still significant in the model.

On December 3, 2019, pre-intervention and post-intervention trends, together with their differences are insignificant to the model. In addition to this, Duterte's statement leads to an increase of 476 points. Pre-intervention trends become significant in the detrended variables, while the other two trend variables remain insignificant.

For all four dates, the dummy variable *Anti-Oligarch* is insignificant.

TABLE 4. Scenario 2: Against oligarch statements regression results

Variables	August 1, 2016		August 3, 2018		April 17, 2019		December 3, 2019	
	PSEi close	PSEi close detrended	PSEi close	PSEi close detrended	PSEi close	PSEi close detrended	PSEi close	PSEi close detrended
Anti-Oligarch	-6.8	-7.52	48.25	64.18	10.52	28.69	-76.78	-65.75
	(66.43)	(65.54)	(72.89)	(72.07)	(66.4)	(66.41)	(59.71)	(60.54)
Reverse Repurchase Rate	-743.97***	-741.95***	-330.30***	-256.60***	-687.37***	-681.75***	-739.96***	-741.40***
	(64.43)	(61.35)	(103.23)	(94.43)	(61.4)	(57.74)	(63.31)	(60.54)
Inflation Rate	-174.15***	-165.97***	-345.63***	-364.71***	-234.21***	-228.12***	-198.49***	-184.29***
	(13.26)	(12.99)	(35.18)	(33.29)	(17.52)	(17.24)	(14.61)	(14.33)
Global Interest Rate	1163.39***	1096.80***	459.91***	262.63*	812.39***	415.95*	1353.26***	1245.24***
	(91.91)	(83.13)	(155.89)	(145.17)	(254.87)	(249.65)	(119.69)	(109.61)
Pre-Intervention Trend	14.60***	19.13***	2.43***	3.19***	0.78	2.01***	-1.15	-0.88***
	(2.52)	(1.31)	(0.59)	(0.57)	(0.75)	(0.76)	(0.23)	(0.22)
Immediate Effect	-560.87***	-541.25***	-188.40*	-247.78**	-366.72***	-318.86***	476.12***	404.32***
	(63.1)	(54.28)	(117.14)	(106.98)	(67.12)	(61.45)	(93.83)	(87.92)
Difference (Pre- and Post-Intervention Trends)	-15.19***	-19.59***	-6.32***	-7.45***	-2.42	-5.60***	-0.57	-3.4
	(2.52)	(1.3)	(1.25)	(1.2)	(2.1)	(2.08)	(3.66)	(2.94)
Post-Intervention Trend	-0.58***	-0.45***	-3.90**	-4.26***	-1.64	-3.59***	-1.72	-4.37
	(0.16)	(0.15)	(0.74)	(0.7)	(1.39)	(1.35)	(3.62)	(2.9)
Constant	6159.94***	6422.63***	7331.28***	7799.23***	7065.03***	8351.53***	5396.70***	5721.64***
	(220.94)	(197.9)	(433.84)	(420.71)	(801.68)	(798.88)	(311.55)	(290.71)
F-statistic	55.34	90.71	54.18	66.9	43.79	48.73	43.88	47.07
Prob>*F*	0	0	0	0	0	0	0	0

***significant at the 1-percent level, **significant at the 5-percent level, *significant at the 10-percent level
Figures in parenthesis are standard errors.

Scenario 3: Personal Attack Statements

Table 5 shows the estimated impacts of Duterte's statements of personal attack made between August 2016 and September 2019. On August 3, 2016, we see a decrease of 570 points post-intervention, with the trend being at -0.57 point following Duterte's remark. After August 3, we see a decrease of 561 points, and a post-intervention decrease of 0.44 point. The control variables on the other hand show significant results.

On March 30, 2017, despite the pronouncement that day, pre-intervention prices increased by 846 points. Even with the increase, there was a 0.69 -point decrease in prices post-intervention.

On September 27, 2017, we see an increase of 674 points immediately following Duterte's remarks, contrary to the expectation. Despite this, we see a post-intervention decrease of 2.25 points daily, and an overall 3.32 -point decrease in pre- and post-intervention trends. Similar results are shown in the iteration using detrended values as well.

On September 18, 2019, there is a drop of 298.76 points immediately following intervention. Despite this price decrease, there is a post-intervention increase of 14.27 points. Regressions utilizing detrended PSEi close show similar results, with the exception of a significant pre-intervention trend. In addition to this, the immediate price decrease following the September 18th statement results in a much larger drop compared to that of the regular PSEi close regression—a 346.38-point price decrease.

For all three dates, the three dummy variable *Personal Attack* is insignificant.

TABLE 5. Scenario 3: Personal attack statements regression results

Variables	August 3, 2016		March 30, 2017		September 27, 2017		September 18, 2019	
	PSEi close	PSEi close detrended	PSEi close	PSEi close detrended	PSEi close	PSEi close detrended	PSEi close	PSEi close detrended
Personal Attack	-33.2	-64.42	-59.51	-76.39	6.9	-17.24	-16.4	-41.89
	(75.57)	(76.6)	(88.37)	(80.98)	(86.55)	(76.13)	(76.03)	(77.92)
Reverse Repurchase Rate	-747.94***	-746.05***	-510.50***	-553.67***	-165.33**	-175.44**	-766.76***	-760.06***
	(64.68)	(61.6)	(78.38)	(77.72)	(74.65)	(69.82)	(64.5)	(61.08)
Inflation Rate	-173.11***	-164.90***	-163.96***	-152.45***	-256.61***	-246.59***	-215.56***	-197.45***
	(13.23)	(12.95)	(12.67)	(12.3)	(15.76)	(15.26)	(16.12)	(15.81)
Global Interest Rate	1163.98***	1096.94***	763.56***	2748.98***	509.13***	443.49***	1596.79***	1369.05***
	(91.4)	(82.7)	(100.25)	(95.32)	(118.35)	(108.13)	(164.82)	(161.09)
Pre-Intervention Trend	13.38***	16.67***	-4.87***	-5.40***	1.07**	1.14**	-1.74	-1.14***
	(2.15)	(1.66)	(0.51)	(0.54)	(0.48)	(0.48)	(0.36)	(0.38)
Immediate Effect	-570.50***	-561.12***	846.16***	835.51**	674.60***	705.83***	-298.76***	-346.48***
	(60.83)	(55.91)	(78.72)	(83.23)	(60.76)	(59.84)	(82.9)	(93.03)
Difference (Pre- and Post-Intervention Trends)	-13.95***	-17.10***	4.19***	4.91***	-3.32***	-3.23***	16.00***	13.14***
	(2.15)	(1.66)	(0.54)	(0.57)	(0.5)	(0.51)	(2.04)	(2.03)
Post-Intervention Trend	-0.57***	-0.44***	-0.69**	-0.49***	-2.25***	-2.09***	14.27***	11.99***
	(0.16)	(0.14)	(0.14)	(0.13)	(0.23)	(0.21)	(1.77)	(1.76)
Constant	6178.51***	6445.76***	7007.64***	7186.05***	6594.17***	6836.73***	4680.40***	5374.94***
	(217.6)	(195.24)	(190.62)	(174.03)	(255.98)	(228.57)	(462.7)	(469.01)
F-statistic	57.28	76.86	63.7	65.86	65.44	67.39	48.16	48.9
Prob>*F*	0	0	0	0	0	0	0	0

***significant at the 1-percent level, **significant at the 5-percent level, *significant at the 10-percent level
Figures in parenthesis are standard errors.

Scenario 4: Interaction between Initial Pronouncements and Anti-Oligarch statements made by Duterte

As shown in Table 6, on August 1, 2016, there is an immediate price drop of 567.84 points, followed by a price trend decrease of 0.61 point daily following Duterte's statements about business and oligarchs. For the dummy variables representing his statements, we see that all three show inconclusive and insignificant results. Regressing against the detrended closing prices, we see similar results of a price drop and price trend decrease. The three dummy variables remain insignificant.

On August 3, 2018, the immediate effect of this intervention is insignificant but still results in a significant post-intervention decrease of 4.05 points daily. We see similar results using detrended close prices, with the exception of the immediate effect, and the initial pronouncement and anti-oligarch interaction dummy. In this iteration, the dummy is significant. It is also seen that following the pronouncement made that day, there is a 251.14-point decrease.

On April 17, 2019, the pre-intervention trend, post-intervention trend, and the difference between them are insignificant. Despite this, there is a 362.33-point price drop after the statement was made. Using detrended prices, we see that the initial pronouncement and interaction dummy are now significant. Trends are also significant in this iteration, with a pre-intervention increase of 2.01 points daily and a post-intervention trend of a decrease of 3.67 points. The rest of the variables show similar values and significance.

TABLE 6. Effects of the interaction between initial pronouncement and anti-oligarch statements

	August 1, 2016		August 3, 2018		April 17, 2019	
Variables	PSEi close	PSEi close detrended	PSEi close	PSEi close detrended	PSEi close	PSEi close detrended
Initial Pronouncement	-178.78	-288.93	-91.75	-195.66	-83.81	-196.33***
	(98.33)	(56.41)	(128.32)	(86.17)	(111.29)	(62.26)
Lagged_Anti-Oligarch	73.35	53.57	116.64	106.64	84.89	76.86
	(71.12)	(66.55)	(71.39)	(66.86)	(71.19)	(67.26)
Initial Pronouncement & Anti-Oligarch Interaction	168.63	278.3	139.82	225.59*	94.73	221.55**
	(115.61)	(83.41)	(144.54)	(109.26)	(127.03)	(87.73)
Reverse Repurchase Rate	-746.61***	-745.02***	-327.67***	-256.24***	-691.37**	-684.31**
	(64.66)	(61.42)	(103.21)	(94.43)	(61.8)	(57.9)
Inflation Rate	-174.64***	-166.44***	-351.10***	-366.53***	-234.53***	-228.19***
	(13.22)	(12.86)	(35.14)	(33.1)	(17.52)	(17.18)
Global Interest Rate	1174.73***	1107.44***	445.26***	273.71*	773.53***	421.48*
	(92.79)	(83.42)	(144.43)	(145.81)	(256.07)	(249.26)
Pre-Intervention Trend	15.03***	19.13***	2.55***	3.19***	0.94	2.01***
	(4.94)	(1.31)	(0.59)	(0.57)	(0.76)	(0.76)
Immediate Effect	-567.84***	-544.47***	-185.49	-251.14**	-362.33***	-312.47***
	(70.68)	(54.14)	(116.95)	(106.36)	(67.15)	(60.98)
Difference (Pre- and Post-Intervention Trends)	-15.64***	-19.60***	-6.60***	-7.49***	-2.89	-5.68***
	(4.93)	(1.31)	(1.26)	(1.2)	(2.12)	(2.07)
Post-Intervention Trend	-0.61***	-0.47***	-4.05**	-4.30***	-1.95	-3.67***
	(0.16)	(0.15)	(0.74)	(0.7)	(1.39)	(1.34)
Constant	6197.82***	6395.18***	7374.40***	7757.59***	7196.31***	8336.15***
	(225.95)	(199.01)	(435.38)	(421.31)	(810.61)	(797.49)
F-statistic	42.78	72.3	42.51	53.91	34.6	38.79
Prob>*F*	0	0	0	0	0	0

***significant at the 1-percent level, **significant at the 5-percent level, *significant at the 10-percent level
Figures in parenthesis are standard errors.

Scenario 5: Interaction between Initial Pronouncements and Personal Attack statements made by Duterte

As shown in Table 7, immediately after Duterte's statement on August 1, 2016, there was a huge price drop of 588.95, and subsequently a price trend decrease of 0.57 points daily. Moreover, the global interest rates increased the stock prices by 1161.22 points, while reverse repurchase rates and inflation rates decreased stock prices by 747.59 points and 173.21 points, respectively. The three dummy variables representing Duterte's buiness pronouncements and personal attacks are insignificant in this iteration. Using detrended close prices in the second iteration, we see results of similar value and magnitude. The control variables show the same results as seen from using untreated prices.

On August 1, 2016, after Duterte's statements, there was a price decrease of 301 points, but a trend increase of 14.34 points daily. Pre- and post-intervention trends result in a difference of 16.05 points. Similar to the results derived using an earlier date, global interest rates contributed to a price increase, while reverse repurchase and inflation rates both contributed to a decrease. The dummy variables for Duterte's stamenents still show insignificant results. There is a minimal difference between the two iterations in the detrended version.

On March 30, 2017, the pre-intervention trend results in insignificant estimates. Despite Duterte's statement, there seems to be an immediate increase of 849.94 points to close prices, but a decrease in the price trend of 0.68 points. The three dummy variables are still insignificant in this iteration. In the second iteration using detrended data, the results are similar, except for pre-intervention trends. In this case, it is significant, and shows a 5.40 point decrease daily, before Duterte's statement.

For all three dates, the three dummy variables were insignificant.

TABLE 7. Effects of the interaction between initial pronouncement and personal attack statements

	August 3, 2016		September 18, 2019		March 30, 2017	
Variables	PSEi close	PSEi close detrended	PSEi close	PSEi close detrended	PSEi close	PSEi close detrended
Initial Pronouncement	-67.32	-79.12	-82.34	-81.86	-16.67	-38.76
	(66.86)	(66.2)	(62.35)	(62.99)	(52.57)	(48.98)
Lagged_Personal Attack	64.75	17.34	67.12	24.74	22.14	-7.28
	(97.76)	(99.38)	(103.21)	(104.11)	(91.49)	(95.73)
Initial Pronouncement & Personal Attack Interaction	32.93	12.59	65.01	37.5	-41.95	-38.57
	(95.22)	(95.82)	(94.34)	(97.13)	(97.16)	(89.41)
Reverse Repurchase Rate	-747.59***	-745.72***	-768.32***	-760.17***	-512.69**	-554.58**
	(64.65)	(61.57)	(64.62)	(61.09)	(78.72)	(77.82)
Inflation Rate	-173.21***	-164.93***	-215.15***	-198.01***	-164.02***	-152.41***
	(13.26)	(12.96)	(16.22)	(15.78)	(12.69)	(12.31)
Global Interest Rate	1161.22***	1092.51***	1592.78***	1374.40*	766.94***	748.00*
	(91.4)	(82.72)	(164.62)	(161)	(100.67)	(95.18)
Pre-Intervention Trend	13.94***	18.36***	-1.71***	-1.16***	-4.98	-5.40***
	(3.99)	(2.06)	(0.36)	(0.38)	(0.53)	(0.54)
Immediate Effect	-588.95***	-579.09***	-301.08***	-342.75**	849.94***	834.32***
	(66.06)	(58.76)	(83.56)	(93.62)	(79.64)	(83.5)
Difference (Pre- and Post-Intervention Trends)	-14.51***	-18.79***	16.05***	-13.30***	4.30***	4.92***
	(3.98)	(2.05)	(2.07)	(2.06)	(0.56)	(0.57)
Post-Intervention Trend	-0.57***	-0.42***	14.34**	12.14***	-0.68***	-0.48***
	(0.16)	(0.15)	(1.8)	(1.8)	(0.14)	(0.13)
Constant	6253.57***	6452.01***	4685.80***	5359.88***	6990.79***	7193.80***
	(221.79)	(196.55)	(464.41)	(468.37)	(192.25)	(174.7)
F-statistic	46.52	73.15	37.92	38.32	49.21	51.13
Prob>*F*	0	0	0	0	0	0

***significant at the 1-percent level, **significant at the 5-percent level, *significant at the 10-percent level
Figures in parenthesis are standard errors.

Scenario 6: Interaction between Anti-Oligarch and Personal Attack statements made by Duterte

We test the date March 30, 2017 in this intervention scenario. As shown in Table 8, following Duterte's statement, we see an increase of 851 points, contrary to our expectations. Despite this, there is a price decrease of 0.69 point post-intervention. Regression using detrended prices shows the same results in terms of similar values and magnitudes.

The three dummy variables were insignificant in both untreated and detrended iterations.

TABLE 8. Effects of the interaction between anti-oligarch and personal attack statements

	March 30, 2017	
Variables	PSEi close	PSEi close detrended
Anti-Oligarch	12.43	22.82
	(58.85)	(51.95)
Lagged_Personal Attack	16.9	-18.84
	(91.01)	(94.69)
Anti-Oligarch & Personal Attack Interaction	-70.56	-99.1
	(101.45)	(92.01)
Reverse Repurchase Rate	-512.04***	-553.11***
	(78.58)	(77.68)
Inflation Rate	-164.05***	-152.46***
	(12.68)	(12.31)
Global Interest Rate	767.60***	749.20***
	(100.65)	(95.02)
Pre-Intervention Trend	-4.98***	-5.39***
	(0.53)	(0.54)
Immediate Effect	850.85***	836.22***
	(79.48)	(83.18)
Difference (Pre- and Post-Intervention Trends)	4.29***	4.90***
	(0.56)	(0.57)
Post-Intervention Trend	-0.69***	-0.49***
	(0.14)	(0.13)
Constant	6985.38***	7182.45***
	(192.64)	(196.55)
F-statistic	49.21	51.26
Prob>*F*	0	0

***significant at the 1-percent level, **significant at the 5-percent level
*significant at the 10-percent level
Figures in parenthesis are standard errors.

Under the current intervention scenario, the reverse repurchase rate and inflation rate decrease the PSE closing price, while US interest rates increase it.

6. Discussion and Analysis

Using interrupted time series analysis, we confirm our hypothesis that Duterte's anti-business pronouncements indeed negatively impact stock prices. Throughout the six intervention scenarios and out of nine dates tested, five show immediate price decreases following President Duterte's statements on August 1 and 3 of 2016, August 3 of 2018, and April 17 and September 18 of 2019. The immediate effects are stark, ranging from 200-600-point decreases in PSEi close prices. Interestingly, of the four other dates when Duterte made a statement, only October 28, 2019 does not show any price drop. The three other dates—December 3, 2019; March 20, 2017; and September 27, 2017—also do not show price decreases immediately after the pronouncements, but instead, show a decrease in price trends post-intervention. The overall effects are summarized in Tables 9 and 10 below. We take a closer look at the specific dates and pronouncements tested in the model to shed more light on the effects they influence. On August 1st of his first year in office, the president made an announcement calling out oligarchs for "…getting rich at the expense of our native land" [GOVPH 2016]. Immediately after the statement was made, we see a drop of around 570 points, as well as a

decrease in price trends overall. We see the same trend on August 3rd, where the president targeted Roberto Ongpin, a Filipino businessman, and mentioned him in a plan to destroy the oligarchs embedded in the government [Ranada 2016]. In this case, prices dropped by around the same amount, followed by drops in price trends. Since the two statements were made in 2016, the president uttered them early in his term. The novelty of these statements could explain why led to price decreases that are greater than those that followed his later statements, as indicated by the results of the nine intervention dates tested here.

TABLE 9. Summary of regression variables Part 1 (significance & effects)

	August 3, 2016		October 28, 2019		September 18, 2019		April 17, 2019		August 1, 2016	
Variables	PSEi close	PSEi detrended	PSEi close	PSEi detrended	PSEi close	PSEi detrended	PSEi close	PSEi detrended	PSEi close	PSEi detrended
Initia Pronouncement	—	—	—	(—)	—	—	—	—	—	—
Anti-Oligarch							+	+	—	—
Personal Attack	—	—			—	—				
Lagged_Anti-Oligarch							+	+	+	+
Lagged_Personal Attack	+	+			+	+				
Initial Pronouncement & Anti-Oligarch Interaction							+	(+)	+	+
Initial Pronouncement & Personal Attack Interaction	+	+			+	+				
Anti-Oligarch & Initial Pronouncement Interaction										
Reverse Repurchase Rate	(—)	(—)	(—)	(—)	(—)	(—)	(—)	(—)	(—)	(—)
Inflation Rate	(—)	(—)	(—)	(—)	(—)	(—)	(—)	(—)	(—)	(—)
Global Interest Rate	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)
Pre-Intervention Trend	(+)	(+)	(—)	(—)	(—)	(—)	+	(+)	(+)	(+)
Immediate Effect	(—)	(—)	(+)	(+)	(—)	(—)	(—)	(—)	(—)	(—)
Difference (Pre- and Post-Intervention Trends)	(—)	(—)	(+)	(+)	(+)	(+)	—	(—)	(—)	(—)
Post- Intervention Trend	(—)	(—)	+	(+)	+	(+)	—	(—)	(—)	(—)
Constant	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)

( ) significant at the 10 percent level
+ indicates a price increase
— indicates a price decrease

Three other statements made later on in Duterte's presidency show immediate decreases in price as well post-intervention. On August 3, 2018, Duterte stated that if it were up to him, he would not renew the franchise of a major telecommunication company, ABS-CBN [Ranada 2018]. This particular remark would begin his many tirades and further pronouncements on the subject. Following his remark, there was an immediate dip of 188 points in the market. A bigger dip of 388 points happened on April 17, 2019 when he threatened Manila Water and Maynilad [CNN Philippines 2019], two of the country's main private water utility companies. His later remark made on the September 18, 2019, while related to his earlier pronouncement on August 3, targeted the Lopez family, owners of ABS CBN, one of the country's biggest broadcasting firms. He continued his attack of the Lopezes and stated how they have "never paid a single centavo" of their loans [Ranada 2019]. This particular tirade was followed by 301-point decreases in prices.

TABLE 10. Summary of regression variables Part 2 (significance & effects)

Variables	August 3, 2018		December 3, 2019		March 30, 2017		September 27, 2017	
	PSEi close	PSEi detrended	PSEi close	PSEi detrended	PSEi close	PSEi detrended	PSEi close	PSEi detrended
Initial Pronouncement	+	+	—	—	—	—		
Anti-Oligarch					+	+		
Personal Attack					—	—	+	—
Lagged Anti-Oligarch	+	+			+	—		
Lagged Personal Attack					+	—		
Initial Pronouncement & Anti-Oligarch Interaction	+	(+)						
Initial Pronouncement & Personal Attack Interaction					—	—		
Anti-Oligarch & Initial Pronouncement Interaction					—	—		
Reverse Repurchase Rate	(—)	(—)	(—)	(—)	(—)	(—)	(—)	(—)
Inflation Rate	(—)	(—)	(—)	(—)	(—)	(—)	(—)	(—)
Global Interest Rate	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)
Pre-Intervention Trend	(+)	(+)	—	(—)	(—)	(—)	(+)	(+)
Immediate Effect	(—)	(—)	(+)	(+)	(+)	(+)	(+)	(+)
Difference (Pre- and Post-Intervention Trends)	(—)	(—)	—	—	(+)	(+)	(—)	(—)
Post- Intervention Trend	(—)	(—)	—	—	(—)	(—)	(—)	(—)
Constant	(+)	(+)	(+)	(+)	(+)	(+)	(+)	(+)

( ) significant at the 10 percent level
+ indicates a price increase
— indicates a price decrease

We take a further look into the four statements that did not make such an effect on PSEi close prices. On March 30, 2017, we note the president's angry sentiments about how he is portrayed in the media. He then ranted about the country's "oligarchs" and attacked prominent media company onwers, specifically, the Lopezes and Prietos. He remarked, unpresidentially, that they are "… full of shit" [Ranada 2017]. Despite his strong and shocking language, there was no immediate drop in PSEi close. His statement on December 3, 2019, once again targeted ABS-CBN but this time included a threat not to renew their franchise that was then ending [CNN Philippines 2019]. His pronouncement on September 27, 2017 found a new target in Lucio Tan, a wealthy businessman who owns Philippine Airlines. Duterte threatened to close the airport if Tan's debts to the government are not paid [Corrales 2017]. Then, during his talk about the water crises on October 28, 2019, he announced a veiled threat of a government takeover of the water utility services from private companies. [ABS-CBN News 2019].

In each intervention scenario, we classify these specific negative business pronouncements based on their content. We identify the three main dummy indicators in the study—*Initial Pronouncement, Anti-Oligarch,* and *Personal Attack*. We then used these dummy variables, both alone and its interaction with another, in the regression to tease out their independent and interaction effects. In almost all estimates, we find that the three dummy variables to be insignificant. In other words, our classification of the President's pronouncements are in themselves insignificant. However, we do find evidence of price drops following his negative business pronouncements (of one type or another).

Besides the interventions and dummies, we include other variables in the regression that may control for other phenomena concerning stock prices. Overall, the activity of the variables aligns with our expectations mentioned in Section 3. With reverse repurchase rate as a proxy for national monetary policy, its effect reflects in the regression results and is negative in almost all the iterations. The inflation rate finds itself significant but negatively related as well to stock prices. Lastly, global interest rates, as proxied by the US daily interest rate, is the only variable that is positively related with PSEi closing price. Overall, these control variables also have their own significant effect on the stock market, and help paint a better picture of investor expectations and behavior.

Another observation that can be made concerns the two dependent variables. The detrended PSEi prices are derived as simple moving averages of the normal prices. It is not surprising that they are affected in the same way by the regressors in our time series model. Essentially, the PSEi closing price or its detrended value can be used to determine the effects of the presidential pronouncements, and the differences in the results for using one rather than the other are shown here to be negligible.

6.1. Aggregate Loss Estimation

To further assess the economic consequences of Duterte's words, we calculate for the aggregate losses of the PSEi after the pronouncement, both instantaneously and after five-day and ten-day adjustment periods. Again, we use only the pronouncements made from 2018 to 2019 for which we have the required data. To calculate the instantaneous loss after a particular event, we apply the following formula:

$$(PSEi\ closing\ price - SMA) \times volume = instantaneous\ loss \quad (2)$$

where *PSEi closing price* refers to the actual price, *SMA* equals the standard moving average calculated within a five-day time horizon, and *volume* refers to the trading volume for that day.

Since our results also suggest that fluctuations in prices occur after a few days lag, we consider the aggregate loss after a five- and ten-day adjustment period to account for those cases when the market does not react instantaneously to Duterte's pronouncement. An adjustment period is taken to be the length of time from the announcement until the time when the PSEi goes to pre-intervention trend. We assume that the PSEi does not follow a new trend post-intervention for estimation purposes. Our formula for estimating the losses over five days after a pronouncement is:

$$\sum_{i=1}^{5} ((PSEi\ closing\ price - SMA_i) \times volume_i) = 5\ day\ loss \quad (3)$$

where *PSEi closing price* and *volume* are as defined above. As shown below, our formula for calculating the ten-day losses simply extends the five-day period in the previous formula to the next five succeeding days:

$$\sum_{i=1}^{10} ((PSEi\ closing\ price - SMA_i) \times volume_i) = 10\ day\ loss \quad (4)$$

We then individually add the values computed for the three types of losses, resulting in an aggregate value that shows the total instantaneous, five-day, and ten-day losses for all the pronouncements in question. This is the accumulated difference between the standard moving average within a five-day time horizon and the PSEi closing price, multiplied by the entire trading volume for all the days Duterte made pronouncements.

To get a better sense of the relative magnitudes of the aggregate losses, we also express them as ratios to the average Gross Domestic Product from 2016 to 2019. Implicitly, then, we compare the losses in stock prices to national income. In addition, we expressed the losses from each pronouncement as ratios to the market capitalization of the Philippine Stock Exchange. The market capitalization at a given time is derived by multiplying the PSE's entire outstanding shares by the prevailing market price at that point. When the losses are expressed as shares in the PSE's market capitalization, we are effectively measuring the losses in investors' wealth. Both the GDP and market capitalization data are sourced from the BSP.

TABLE 11. Aggregate losses (in pesos)

Date	Instantaneous	5-day Period	10-day period
August 3, 2018	16182405.08	46570417.68	-420011776.1
April 17, 2019	-6513519.5	29860704.27	266559405.6
September 18, 2019	-2418828.868	-92762659.64	-441051671
October 28, 2019	2585174.68	105912306.7	287142040.4
December 3, 2019	5681431.714	-30912429.49	-153667596.6
TOTAL	-1330490.849	-47243967.18	-461029597.7

TABLE 12. Aggregate losses as percent of market capitalization

Date	Instantaneous	5-day Period	10-day period
August 3, 2018	9.4216E-05	0.000271139	-0.002445363
April 17, 2019	-3.75565E-05	0.000172175	0.001536965
September 18, 2019	-1.42629E-05	-0.000553895	-0.002633563
October 28, 2019	1.52437E-05	0.000624522	0.00169316
December 3, 2019	3.40097E-05	-0.000185045	-0.000919871

TABLE 13. Aggregate losses as percent of average Gross Domestic Product

Instantaneous	5-day Period	10-day period
-7.66074E-06	-0.000272023	-0.002654529

As shown in Table 11, the pronouncement on September 18, 2019—an attack against the Lopez family—generated the highest amount of instantaneous losses, and even in terms of five-day and ten-day losses. After that pronouncement was made, PSEi immediately lost ₱2,418,828.68. Its losses then rose to ₱92,762,659.64 in five days and ₱441,051,671 in ten days

We also calculate aggregate losses by adding the instantaneous, five-day and then ten-day individual losses individually. Immediately after the pronouncement was made, we estimated that the PSEi lost a total of ₱1,330,490.849. In five days, the losses ballooned to ₱47,243,967.18. Then, in ten days, it skyrocketed to ₱441,051,671.

While the daily instantaneous data would evidently lead to inconsequential results, we find that the ten-day aggregate loss from a single event is estimated to cost the Philippine economy 0.0027 percent of the GDP. We find that, within a ten-day period, the pronouncement against the Lopezes also generated the highest number of losses at 0.0026 percent of the stock market value for the month of September 2019.

7. Conclusion

The biggest changes in the PSEi and to stock market returns are recorded from the first two business pronouncements the president made on August 1 and 3 of 2016. This finding suggests that his rhetorical style has its greatest shock effects early in his term. Moreover, the results also suggest that investors may have grown accustomed to the president's style as his subsequent announcements were followed by narrow fluctuations in stock returns. Our results indicate that none of the dummy variables used to classify Duterte's pronouncements is significant across estimations. In other words, the market reaction is provoked by no particular type of business-related statements of the president.

We also calculated the aggregate losses for the period 2018-2019 for the day immediately following the announcement, for the next 5 days, and for the next 10 days following the same. We find the aggregate losses to be biggest following the Duterte's attack against the Lopezes on September 18, 2019. The resulting 10-day loss is equivalent to 0.0027 percent of the market capitalization of the PSE. Moreover, the total instantaneous losses of the PSEi after all the six pronouncements considered here amounted to ₱1,330,490.85. This rose to ₱ 47,243, 967.18 within five days, and then to ₱441,051,671 within ten days following the pronouncements.

By design, this study is limited to selected negative business-related pronouncement of the president. Possibly, his other business-related pronouncements may have had a positive effect on the stock market. Or, his attack against other sectors—such as members of the opposition, the Catholic Church, or those against hos war of drugs—may also have their own economic consequences. Likewise, his pronouncements after 2019 could have jilted business confidence and outlook. In other words, our estimates provide only a partial assessments of the full economic consequences of President Duterte's words.

Overall, our results show that Duterte's ire against businessmen endangered the business sector leading to significant wealth losses. Investors are known to stand guard against anything that can threaten their future cash inflows such as destabilizing nature of Duterte's negative pronouncements. It is particularly jarring how, in assessing the nature of these utterances, one can easily conclude that his outbursts tend to be personal, unnecessarily explosive, and easily prevented. Insofar as our findings indicate his words have significant economic consequences, they are relevant to financial analysts, researchers and public relations managers who are interested in the link between investors' behavior and confidence and the rhetorics of political leaders. They also contribute to the active academic discussion on populist stongmen found in many countries. Most importantly, perhaps, they may also provide some vital information to voters and citizens in general, who have the right and freedom to demand accountability from their elected leaders and government institutions.

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The Philippine Review of Economics
57(1): 101-120. DOI: 10.37907/5ERP0202J

The conditional altruist and the Samaritan's dilemma

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The Samaritan's dilemma refers to any situation in which an actual or expected altruistic behavior of one actor generates an incentive for exploitation on the recipient, such that the altruist suffers a welfare loss beyond the cost of the originally intended transfer. This study hypothesized that the Samaritan's dilemma condition does (not) apply when the help given is a substitute for (complement to) the effort of the beneficiary to help herself. Using static and sequential game analyses, it is proven that either substitution or complementary condition could arise in the act of giving and receiving help. It is in the substitution condition only that the Samaritan dilemma arises. The players in a sequential game, with the first-mover advantage, can transform the game's payoffs by setting assistance or work effort at the outset that forces the other player to adjust. Thus, Buchanan's Samaritan's dilemma is not a universally strategic outcome in the altruistic acts of giving. The empirical part tested if the Samaritan's dilemma pervades or not in Philippine households by investigating the effects of expenditures of gifts on work hours. Household total transfers (consumption gifts plus remittances) and household members' work effort are found substitutes. Thus, the Samaritan's dilemma equilibrium is implied. However, there is also an implied equilibrium outside that of the Samaritan's dilemma among high-effort workers: for these theoretically "altruist" workers, the gifts and income transfers are complementary to work hours.

JEL classification: D64, D01
Keywords: altruism, games, dilemma

1. Introduction

In his essay entitled "The Samaritan's dilemma", Buchanan [1975] presented a prescriptive diagnosis of social problems which he analyzed as separate symptoms of the same social disease. He was referring to the Samaritan's dilemma which he said is difficult to solve because the source of difficulty may lie in modern man's

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own utility function. He said, "We may be simply too compassionate for our well-being or for that of an orderly and productive society." He cited increasing economic affluence as only one among many explanations for the pervasive Samaritan's dilemma in twentieth-century Western society. He hypothesized that modern man has become incapable of making the choices that are required to prevent his exploitation by predators of his species, whether the predation is conscious or unconscious.

Technically, the Samaritan's dilemma derives from the altruistic desire of a "Good Samaritan" to help a person in need but may end up being exploited. The exploitative condition happens when the person denies her capability to help herself because of the Samaritan's action, thus the Samaritan's dilemma. Buchanan [1975] was the first to model this into a two-person strategic game, although he was not the first political economist to raise this problem. Its antecedents lie in the closely related problem of moral hazard [Darst 2003]. In game-theoretic terms, the Samaritan's dilemma refers to any situation in which an actual or expected altruistic behavior on the part of one actor generates an incentive for exploitation on the part of the recipient, such that the altruist suffers a welfare loss beyond the cost of the originally intended transfer (Buchanan [1975]; Darst [2003]; Raschky and Schwindt [2009]; Schmidtchen [1999]). The Samaritan's payoff generated from the utility and "warm glow" of being conditionally altruistic is less than when the beneficiary does not exploit the act of charity.

In practice, there are two parts in the most commonly proposed solution to the Samaritan's dilemma that are not far from what Buchanan prescribed. The first part is public pre-commitment to the application of rules designed to punish and deter exploitative behavior. Such rules are likely to take the form of conditionality: assistance will be forthcoming only if the beneficiary agrees to conform to certain behavioral guidelines, and assistance will be cut off if that agreement is violated. The second part, as Buchanan mentioned in the original essay, is delegating the power of decision to an agent, one who is instructed to act in accordance with the strategic norms that are selected in advance [Darst 2003]. In other words, developing institutions are locked into strategic behavior and delegated with power to make decisions.

This paper attempts to explore theoretically, and only partly empirically, the condition of acts of giving and receiving without the familiar Samaritan's dilemma conditions. A vital instrument of exploration in this study is recognizing one type of potential Samaritan, the conditional altruist, along with several types of recipients (parasites in the words of Buchanan's). Given these types of players in the game, there will be other forms of games without the Samaritan's dilemma conditions. The empirical part explores if the Samaritan's dilemma pervades or not in Philippine society through estimation of the effects of expenditures on gift items by households on work hours.

The distinct contribution of this paper is the determination of the beneficiary's strategy if she is substituting or complementing the giver's act of charity. This turned out to be crucial because the nature of the charity (assistance, aid or gift) becomes the determinant of the beneficiary's strategy (specified here simply whether to "work more" or "work less"). As will be shown, the Samaritan's dilemma game condition is not universal as an outcome among acts of giving but depends on the nature of assistance from the perspective of the beneficiary.

Most relevant studies (Bruce and Waldman [1990]; Dijkstra [2007]; Komar [2014]; Faria and Arce [2018]) analyzed the consequences of the Samaritan's dilemma in a two or multi-period model showing time-inconsistency problems akin to a sequential and dynamic Samaritan's game with a Stackelberg leader and follower. Other studies (Schmidtchen [1999]; Coate [2001]; Lagerlof [2004]) are on iterated Samaritan's dilemma game and delegation of power of decision to an agent; the role of government in providing in-kind transfers; and translated Samaritan's dilemma to a signaling game given incomplete information between players. Empirical studies (Raschky and Schwindt [2016]; Heinecke et. al. [2008]; Gibson et. al. [2005]; Deryugina and Kirwan [2017]) estimated the crowding-out effect of foreign aid to recipient countries and farmers where it is interpreted as the presence of the Samaritan's dilemma. None so far of the theoretical models indicated the substitution-complement nature of the assistance given, although most studies readily assumed substitution conditions with the outright assumption that assistance or aid is fungible. However, assistance can be direct in-kind transfers to ensure its complementary nature to the beneficiary's work effort. The empirical part of this paper is similar to the crowding-out effect, but in particular on household expenditures on gifts and work hours.

The objective of this study is to find the game conditions in the acts of giving where there is no Samaritan's dilemma, and this is manifested in the complementary nature of assistance under a given recipient's resource (labor and capital) condition. This is done through the identification of all possible strategies of each player under which the strategic nature of the game still operates. The second objective is to mine empirical evidence of the absence of Samaritan's dilemma using Philippine household data.

To pursue the first objective, the active Samaritan's dilemma game is made into an extended sequential game. In the static active Samaritan's dilemma game, the row player represents the Samaritan, now labeled Giver (G) in this paper, and the column player the Beneficiary (B). Each player faces a choice of two strategies. The Giver's choices are "behave charitably" (C) and "behave non-charitably" (NC) [Buchanan 1975]. In this paper, we will use "work more" (WM) or "work less" (WL) as the two strategies of the Beneficiary. The effort involved with "work more" or "work less" are taken here to be relative to the current work effort of the Beneficiary.

Buchanan presented two forms: active and passive. In the active Samaritan's dilemma, the Giver has already made known his desire to behave altruistically. In the passive version of the game, the prospective Beneficiary acts to stimulate a resource transfer from the Giver. For both the active and passive variants of the Samaritan's dilemma, Buchanan employed a simple 2 × 2 matrix with payoffs "1", "2", "3" and "4", with "4" indicated as the most preferred outcome and "1" the least preferred [Buchanan 1975].

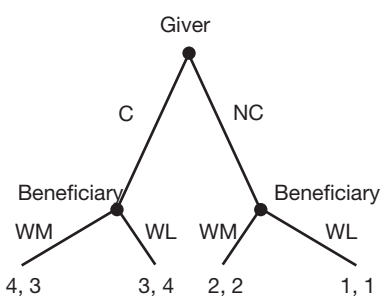
Below are the two extended versions of the active Samaritan's dilemma, where in Case 1a Giver moves first and then Beneficiary follows, and in Case 1b Beneficiary moves first and then Giver follows. In both cases the Nash equilibrium remains the same: the Samaritan (i.e., Giver) is charitable (C), and the Beneficiary works less (WL). Regardless of whether Giver moves first or second, there is no first-move advantage. However, it turns out that the two static forms of Buchanan—active and passive Samaritan's dilemma—are too constricting to depict the set of strategies available to an altruist Samaritan and the beneficiary in a sequential game. Section IV of the paper shows a version of the Samaritan's dilemma where the first mover has an advantage.

The paper proceeds as follows: section two explains when the Giver's assistance and the Beneficiary's work effort may be considered complements or substitutes; section three maps out the set of possible strategies of the two players when the potential games played by them are expanded beyond the static active and passive forms of the Samaritan's dilemma game; section four analyses the utility of the players in one-shot static games and sequential games; section five presents the data and econometric model used and the empirical results.

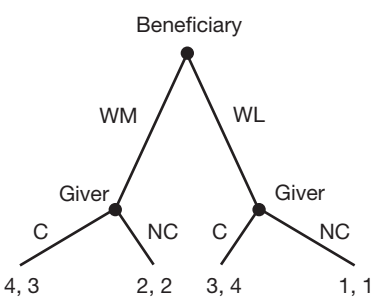
FIGURE 1. Active and passive variants of the Samaritan's dilemma

		Beneficiary	
		WM	WL
Giver	C	4, 3	3, 4
	NC	2, 2	1, 1

Case 1a: Giver moves first



Case 1b: Beneficiary moves first



2. Complementary and substitution conditions and the Samaritan's dilemma game

First, we clarify the economic rationale behind the possible complementarity or substitution between the giver's assistance and the beneficiary's work effort. As a concrete example, consider a farm household that applies its labor on a small piece of land. With only subsistence production, the household then may be deficient in its food consumption. Without external food aid or assistance to cover for the shortfall in their daily calorie and nutrient requirements, the household members will be undernourished or unhealthy. Let us assume further that the farmer optimizes his work effort x^*, equal to four hours, say, given the resource constraint and limited capital. If the external food assistance provided to the household is just enough to offset the shortfall in food and nutrient requirements, then it will have no consequence on current work effort, set at x^*. This outcome, we will call here as a low-complement condition between charitable assistance and work effort. When the food assistance is more than enough to cover the shortfall, then the household may be induced to reduce its work hours by two hours, say, from the current four hours. This outcome, we can call here as a low-substitution condition between charitable assistance and work effort. The same low-substitution outcome will result if the household has optimized work effort and is producing enough food requirements but is given food assistance. Buchanan's Samaritan's dilemma could be more about the low-substitution outcome often noted in welfare states. Schmidtchen [1999] alluded to the rise in the number of those living on transfers in welfare states the widespread belief that the transfers undermine the recipients' incentives to work.

To proceed with our example, now assume the household owns a half a hectare of rain-fed rice farm and four more hectares that can be used for livestock- or poultry-raising and planting seasonal high-value vegetable crops. With a small farm tractor, technical training or technical assistance the household will be able to operate a viable commercial farm. With such assistance, let the household's optimal labor inputs then increase to eight hours. This outcome, we can call here as a high-complement condition between productive assistance and work effort. If the household is provided with a tractor but has no additional farmland, it may opt to rent the tractor out to others and then reduce its work effort. This outcome, we can call here as a high-substitution condition between productive assistance and work effort.

One important note to take in the aforementioned discussion is that the optimal work effort $x^*(y)$ is a function of assistance y. The beneficiary will adjust work effort x to the optimal value $x^*(y)$ attainable. The example above clearly shows that the nature of the Giver's charity (gift) influences the strategic behavior of the Beneficiary. This is the important insight here in our theoretical framework that disagrees with Buchanan's. The hypothesis is that the Samaritan's dilemma is applicable to substitutes, but not to complementary conditions of assistance. The table below provides a summary.

TABLE 1. Charity and work effort: complementary and substitution conditions

Assistance	Current optimum work hours (x^*)	Outcome
A. Without assistance	4 hours	Subsistence w/ shortfall and undernourished
B. Provided with food just enough for the shortfall	4 hours – complementing current work effort with food aid	Subsistence produce + food aid = no shortfall with enough nourishment (low-complement)
C. Provided with food more than the shortfall	2 hours - substituting excess food aid more than the shortfall to 2 hours of subsistence work	Enough nourishment but reduced work hours from optimum (low-substitution)
D. Provided with additional resource capital and technical assistance	8 hours – complementing the provided assistance with skilled labor	Surplus commercial production (high-complement)
E. Provided with inadequate resource capital (tractor)	Reduced work hours – substituting income of new resource (tractor)	Subsistence production with probably enough nourishment (high-substitution)

Buchanan's active Samaritan's dilemma where the Giver plays C and the Beneficiary plays WL in equilibrium is equivalent to the low-substitution condition depicted by letter C in the table. The Giver has a payoff less than when the Beneficiary does not reduce work hours. This is where the altruist suffers a welfare loss beyond the cost of the originally intended transfer. However, as we will show below in a sequential Samaritan's dilemma game, if the Giver moves first, she can set assistance y such that the Beneficiary will set $x^*(y)$ without reduced work hours. This outcome corresponds to the low-complement condition depicted by letter *B* in the table.

3. Mapping the different players' strategies

We can depict a set of strategies of players in the game between the Giver (*G*) and the Beneficiary (*B*). Stated game strategies here are derived with one-to-one correspondence with the payoffs matrix. For example, Case 1 below depicts the game between a Giver who is always charitable (C), and a Beneficiary who reduces work effort (WL) if G is charitable (C). Note that this is the same as Buchanan's [1975] active Samaritan's dilemma where the Nash equilibrium is at (C, WL).

Case 1: *G* is always Charitable (C)
B works less (WL) if *G* is Charitable (C)

		Beneficiary	
		Work more (WM)	Work less (WL)
Giver	Charitable (C)	4, 3	3, 4
	Not-charitable (NC)	2, 2	1, 1

We can map out all possible players' strategies and the resulting outcomes, either with a pure-strategy Nash equilibrium (PNE) or none. Following the tradition of a Good Samaritan, we preserve the behavior of the Giver's willingness to help. The other principle in the mapping exercise is that we are only interested in those cases where at least one player is affected by the behavior of the other player to maintain the strategic nature of the game. Finally, in the interest of study, we identify the combination of the two players' sets of strategies where the dilemma still operates or not.

Before the actual mapping below, there should be an economic rationale of some specific players' behavior (the type of player). The tables below list the potential strategies of the two players. A player's strategy is positively stated first relative to a given strategy of the other player, and then as an equivalent strategy where the first player adopts her other strategy relative to a switch in the other player's strategy. The remarks identify the type of player who will correspond most likely to the stated strategies.

TABLE 2. Giver and Beneficiary sets of game strategies

Giver's Strategy	**Equivalent strategy**	**Remark**
Always C	Always C	*G* is an altruist no matter what *B*'s strategy is
C if *B* is WM	NC if *B* is WL	*G* recognizes complementary condition but is a conditional altruist as she is NC if *B* is WL
C if *B* is WL	NC if *B* is WM	*G* is idle by not signaling, not giving while *B* is WM, but altruistic behavior is triggered by *B*
Beneficiary's Strategy	**Equivalent strategy**	**Remark**
Always WM	Always WM	*B* is an altruist worker no matter what *G* is
Always WL	Always WL	*B* is a lazy worker no matter what *G* is. (Disutility of work is always greater than benefits.)
WM if *G* is C	WL if *G* is NC	*B* recognizes complementary condition and chooses best response to *G*'s strategies
WM if *G* is NC	WL if *G* is C	*B* recognizes substitutability between her work effort and the *G*'s assistance

We now proceed to map out the possible interactions between the players. Instead of writing out all potential interesting cases into normal form as above, the table below maps out all the players' strategies and the outcomes. Again, the general rule is that at least one player's behavior is being affected by the other player's behavior, and the Giver's willingness to help (or altruistic behavior) is preserved. All the players' strategies are stated in positive sense; but note of their equivalent statement when player's strategies are reversed.

TABLE 3. Mapping of players' set of game strategies

Cases	Condition	Giver (*G*)	Beneficiary (*B*)	Outcome
Case 1: Active Samaritan's dilemma	Substitutes	Always C	WM if *G* is NC	PNE (C, WL)
Case 2: No dilemma	Complements	Always C	WM if *G* is C	PNE (C, WM)
Case 3: No dilemma*	Complements	Always C	Always WM	PNE (C, WM)
Case 4: No dilemma*	Uncertain	Always C	Always WL	PNE (C, WL)
Case 5: No dilemma but coordination problem arises	Complements	C if *B* is WM	WM if *G* is C	Two PNEs (C, WM) and (NC, WL)
Case 6:	Uncertain	C if *B* is WM	WM if *G* is NC	No PNE
Case 7: No dilemma	Complements	C if *B* is WM	Always WM	PNE (C, WM)
Case 8: No dilemma	Complements	C if *B* is WM	Always WL	PNE (NC, WL)
Case 9:	Uncertain	C if *B* is WL	WM if *G* is C	No PNE
Case 10: Passive Samaritan's dilemma	Substitutes	C if *B* is WL	WM if *G* is NC	Two PNEs (NC, WM) and (C, WL)
Case 11: No dilemma	Substitutes	C if *B* is WL	Always WM	PNE (NC, WM)
Case 12: No dilemma	Substitutes	C if *B* is WL	Always WL	PNE (C, WL)

*Case 3 and 4 are for purposes of comparison although the cases do not have a strategic game condition.

The cases above marked as "No dilemma" refer to those where the Giver faces no dilemma in her choice of strategy. As defined by Buchanan [1975], the dilemma arises when the Giver helps based on her pragmatic interest (altruistic motive), and the Beneficiary changes strategy and works less. What stands out in the mapping of the different types of players is that Buchanan's outcome corresponds to only two versions where the Giver is in a "dilemma", namely in Case 1 (active) and Case 10 (passive). In Cases 12 and 4 where the Beneficiary works less, she does so regardless of what the Giver does, and therefore the Beneficiary cannot be said to exploit the latter.

There are two rules in determining the complementary and substitution conditions. One condition is when each player actively pursues a strategy that is substituting or complementing the other player's strategy. The other condition is when at least one player is substituting or complementing the strategy of the other player, who is indifferent.

Case 5 is the Stag-Hunt version where both the Beneficiary and Giver recognize the complementary condition. In this version, the Giver is not facing a dilemma. However, the problem facing the players now is one of coordination to achieve a Pareto optimal equilibrium. Stag-Hunt games capture strategic interdependence when coordinated cooperation between players yields a superior equilibrium, but a safer equilibrium exists in which players pursue their independent interests [Wydick 2008]. This game condition is reflected in letter D in Table 1.

There is a challenge to explain case 6 where the Beneficiary chooses to work less if the Giver is charitable despite the latter recognizing a potential complementarity condition. This behavior is difficult to explain, and the only reason this could happen is either the Beneficiary lacks information regarding the complementarity condition or has other information that negates the potential benefits of working more. This could arise when the Beneficiary mistrusts the Giver whom she believes, by pretending to be an altruist now, will exploit her eventually in the future. This shows that games with no pure Nash equilibrium are interesting social phenomena.

Case 10 is the passive version of Buchanan's Samaritan's Dilemma game and it turns out to be an analog version to the Hawk-Dove game. In coordination games like Stag-Hunt, the more people engage in a certain behavior, the more attractive that behavior becomes to the individual player. Hawk-Dove games depict the opposite case. The more other players are devoted to a given type of behavior, the more the individual player wants to do something else [Wydick 2008]. Hawk-Dove games are used to depict social conflicts. How could a good Samaritan become engaged in a conflict situation? As in Buchanan [1975], the good Samaritan is put in a ransom-like situation. If she does not help people in dire need, she is bothered by her conscience for letting others succumb to their probable destruction. On the other hand, if she believes nothing worse will befall them, she will not find the need to be charitable to them.

Case 9 is depicts the situation where the Beneficiary works more if the Giver is charitable, or works less if the Giver is not charitable. The only reason that the Beneficiary exhibits this behavior is that she recognizes the complementarity condition of the Giver's assistance to her own work effort. If the Beneficiary recognizes the complementary condition however, why would the Giver fail to recognize the same rather than treat them as substitutes? The only reason this could happen is that the Beneficiary may have additional information that can turn the condition in the opposite direction.

4. Static and sequential utility analyses of the Samaritan's dilemma game

The players' strategies above are further analyzed below through static and sequential game utility analysis. The additional insights gain in this exercise is the determination of the Beneficiary's strategy if she is substituting or complementing the Giver's act of charity. This turned out to be crucial because the nature of the charity (assistance, aid or gift) becomes the determinant of the Beneficiary's strategy to work more or to work less. As will be shown, the traditional outcome in the Samaritan's dilemma game is not universal, other outcomes are possible under different natures of assistance.

The analysis below only considers the utilities of the conditional altruist Giver and a normal Beneficiary worker. As discussed in the mapping exercises summarized in Table 2, both "altruist" and lazy workers are possible. However,

those types will not be included in the analysis in this section, but will be considered again in the empirical tests. With regards to the Giver, we shall assume always that she is an altruist, albeit in some cases she does not signal her altruism.

Let the utilities of the Giver, U^G, and Beneficiary, U^B, be as represented below. As an altruist, the Giver derives pleasure in helping people in need. Thus, the utility function U^B enters U^G following that of Dijkstra [2007]. Charity y is a disutility to the Giver but it is compensated by her altruistic desire to help. The Giver also knows that her charity y directly affects the work effort x of the Beneficiary, and she values x positively as x increases relative to current effort. Since x enters the U^G, the Giver then is said to be a conditional altruist, because some altruists may not be concerned at all of the Beneficiary's effort x. For the Beneficiary, work effort x is a function of the Giver's charity y. There is an optimal effort x for every charity y. Other than this, charity y has an independent positive effect on U^B.

$$U^G(-y, x(y), U^B(x(y), y))$$

where, y is the value of the gift/aid/help of the G.
x is the work effort of beneficiary B and is a function of charity y.
U^B is the utility of B where it is a function of x and y.
U^G is the utility of G where it is a function of y, x, and U^B.

The following characteristics describe the utility functions, U^B and U^G.

$\frac{\partial U^B}{\partial x} > [<]\ 0, for\ x < [>]\ x^*(y)$

where $x^*(y) > 0$

Given the G's y, there is an optimal effort $x^*(y)$ for the B, where the marginal payoff of the extra value of y earned equals the marginal payoff of leisure.

$\frac{\partial^2 U^B}{\partial x^2} < [>]\ 0$

B's marginal utility of x is positive (negative) and decreasing (increasing) depending on $\frac{\partial U^B}{\partial x} > [<]\ 0, for\ x < \{>\}\ x^*(y)$.

$\frac{dU^B}{dy} = \frac{\partial U^B}{\partial y} + \frac{\partial U^B}{\partial x}\frac{\partial x}{\partial y} > 0$, and $\frac{d^2U^B}{dy^2} < 0$

B's marginal utility of y is positive and decreasing.

$\frac{\partial x}{\partial y} < 0, \frac{\partial x}{\partial y} > 0$

Assuming that x and y are substitutes or complements respectively.

$\frac{\partial U^G}{\partial U^B} > 0$, and $\frac{\partial^2 U^G}{\partial U^{B^2}} < 0$, G's marginal utility of U^B is positive and decreasing.

$$\frac{dU^G}{dy} = -\frac{\partial U^G}{\partial y} + \frac{\partial U^G}{\partial x}\frac{\partial x}{\partial y} + \frac{\partial U^G}{\partial U^B}\frac{\partial U^B}{\partial x}\frac{\partial x}{\partial y} + \frac{\partial U^G}{\partial U^B}\frac{\partial U^B}{\partial y} > [<]\ 0,\ for\ y < [>] y\ ,$$

and $\frac{d^2 U^G}{dy^2} < [>]\ y^*$

In words, G's marginal utility of y is positive (negative) and decreasing (increasing) if $y < [>] y^*$. G suffers a disutility proportionate to the value of y she gives, but since she is an altruist the increase in utility of B as y increases more than compensates the disutility. G's overall utility increases as y increases if $y < y^*$. The more she gives, the higher the utility but with diminishing returns. But at $y > y^*$, the disutility of y is more than the increase in utility of B.

$$\frac{dU^G}{dx} = \frac{\partial U^G}{\partial x} + \frac{\partial U^G}{\partial U^B}\frac{\partial U^B}{\partial x} > [<]0, \text{ and } \frac{d^2 U^G}{dx^2} < [>]0$$

In words, G's marginal utility of x is positive or negative, depending on $(\partial U^B / \partial x) > [<]0$, $for\ x < [>] x^*(y)$. Being a conditional altruist, G's utility also increases as work effort x of B increases. This is the same when x is complementary or substitute to G's y. In the complementary case, G finds an increase in B's effort x will increase U^B which then increases U^G. In the substitution case, G finds an increase in B's effort x will decrease U^B (given that y is a substitute, there is no incentive to increase x, thus increasing x leads to more disutility of work to B) which then decreases U^G.

$\frac{\partial x}{\partial y} < 0, \frac{\partial x}{\partial y} > 0$ Assuming that x and y are substitutes or complements respectively.

4.1. Static Game Utility Analysis

Solving for the first-order condition for attaining maxima for both Giver and Beneficiary,

Giver: $U^G(y, x(y), U^B(x(y), y))$:

$$\frac{dU^G}{dy} = -\frac{\partial U^G}{\partial y} + \frac{\partial U^G}{\partial x}\frac{\partial x}{\partial y} + \frac{\partial U^G}{\partial U^B}\left[\frac{\partial U^B}{\partial x}\frac{\partial x}{\partial y} + \frac{\partial U^B}{\partial y}\right] = 0 \qquad (1)$$

Beneficiary: $U^B(x(y), y)$:

$$\frac{dU^B}{dy} = \frac{\partial U^B}{\partial x}\frac{\partial x}{\partial y} + \frac{\partial U^B}{\partial y} = 0 \qquad (2)$$

$$\frac{\partial U^B}{\partial x} = 0 \quad \text{The beneficiary maximizes } x \text{ given } y. \qquad (3)$$

Substitute equation (2) in equation (1),

$$-\frac{\partial U^G}{\partial y} + \frac{\partial U^G}{\partial x}\frac{\partial x}{\partial y} = 0 \quad \text{where} \quad \frac{\partial U^G}{\partial y} < 0 \qquad (4)$$

In equation (4), if $\frac{\partial U^G}{\partial x} > [<]0$, then $\frac{\partial x}{\partial y} > [<]0$ or x is complementary (substitute) to y.

In summary, *B*'s exploitation of *G*'s charity happens only in the substitution case. The complementary case invalidates the Samaritan's dilemma following that in Table 3.

4.2. Sequential Game Utility Analysis

Is there a first-mover advantage like the Stackelberg model of competition? To show this, we take the total derivative of U^B and U^G.

Given $U^G(-y, x(y), U^B(x(y), y))$:

$$dU^B = \frac{\partial U^B}{\partial x}dx + \frac{\partial U^B}{\partial y}dy + \frac{\partial U^B}{\partial x}\frac{\partial x}{\partial y}dy \qquad (5)$$

$$dU^G = -\frac{\partial U^G}{\partial y}dy + \frac{\partial U^G}{\partial x}\frac{\partial x}{\partial y}dy + \frac{\partial U^G}{\partial U^B}\frac{\partial U^B}{\partial y}dy + \frac{\partial U^G}{\partial x}dx + \frac{\partial U^G}{\partial U^B}\frac{\partial U^B}{\partial x}dx \qquad (6)$$

4.3. The Samaritan moves first

If *G* moves first, then *B* as the second mover takes *y* as given. Then *G* expects *B* to maximize her effort *x*, and sets *y* to influence $x^*(y)$ and U^B to maximize her own utility U^G in equation (1). Given *y* is set, then from equation (5), $(dU^B / dx) = (\partial U^B / \partial x)$. The only way for *B* way to maximize her utility U^B is to set *x* such that $(\partial U^B / \partial x) \doteq$. Thus *G* has the *first-mover advantage* to influence *B*'s behavior not to reduce work by setting *y* accordingly. This situation is depicted in letters *B* and D in Table 1 above where the *G* carefully sets her assistance to *B* so that the latter will not reduce her work effort (letter *B* with low-complement condition) or increase work effort (letter D with high-complement condition).

4.4. The Beneficiary moves first

If *B* moves first, then *G* as the second mover takes *x* as given. Then equation (6) becomes

$$\frac{dU^G}{dy} = -\frac{\partial U^G}{\partial y} + \frac{\partial U^G}{\partial x}\frac{\partial x}{\partial y} + \frac{\partial U^G}{\partial U^B}\frac{\partial U^B}{\partial y} = 0 \text{ (assuming optimization by } G\text{)} \quad (7)$$

Substituting equation (4) in (7),

$$\frac{dU^G}{dy} = \frac{\partial U^G}{\partial U^B}\frac{\partial U^B}{\partial y} = 0$$

Substituting equation (2) for $\frac{\partial U^B}{\partial y}$,

$$\frac{\partial U^G}{\partial U^B}\frac{\partial U^B}{\partial x}\frac{\partial x}{\partial y} = 0 \quad (8)$$

where $(\partial U^G / \partial U^B > 0$ and $(\partial U^B / \partial x = 0$ and $(\partial x / \partial y < 0, \partial x /$ whether x is a substitute or complementary to y.

Thus player *B* maximizes her utility with respect to *x* given *y* regardless of whether *x* and *y* are substitutes or complements of each other. She has the *first-mover advantage*. This is intuitive since *B* faces the dual opportunity to exploit the good Samaritan by working less if *x* and *y* are substitutes, and by working more or at least by not working less if *x* and *y* are complements.

The implication of the sequential game utility analysis with regard to the mapping of players' strategies in active and passive form of the Samaritan's Dilemma game is that now the player, with the first-mover advantage, can transform the game's payoffs. By setting *y* in the case of *G* or *x* in the case *B* at the outset, the first-mover can force the other player to adjust. The players in a sequential game, with the first-mover advantage, can thus transform the game's payoffs by setting *y* or *x* at the outset that forces the other player to adjust. If *G* moves first, she will force the game payoffs to resemble case 3 in Table 3. (Since it appears that in sequential and signaling games between a conditional altruist and a normal beneficiary, the cases in Table 3 are all possible, this should be the subject of another paper.)

In a related study, Komar [2014] reviewed theoretical models which analyze the consequences of the Samaritan's dilemma for foreign aid and its possible solutions. Komar has shown similar results above in a two-period model of an economy that whenever the recipient does some savings in equilibrium, the strategic motive induces it to under-save in comparison to what would be optimal if the aid had been exogenously fixed. With time-inconsistency problems arising

particular to the expectations of the beneficiary, the donor (giver) cannot also adhere to a fixed amount of aid committed in advance as *Stackelberg leader*. In relation to the cases shown in Table 1, this is a case where the giver commits (stage 1) to provide a fixed amount of food aid enough to cover for the shortfall, but as the beneficiary anticipates aid she reduces (stage 2) her work hours. In the last stage when the donor disburses the aid, the question is whether the donor will stick to the aid level or policy announced in the first stage after the recipient already chose to reduce work hours. The answer is no because withholding additional aid or punishing the recipient reduces the welfare of both the recipient and the donor. Thus, a donor starting as a Stackelberg leader *ex-ante* will end up being a Stackelberg follower *ex-post*. But this will not be true in the case of letter D in Table 1 because reducing work effort in the complementary condition is not optimal for the beneficiary.

5. Empirical Test

The second and third parts of the theoretical framework above, mapping of players' strategies and static utility analysis, have the following implications on the empirical tests of the study:

1. The mapping of players' strategies directs us to find out empirically if the players are in a game of Samaritan's dilemma or not.
2. The static and sequential game utility analysis directs us to find empirically if the Beneficiary's strategy is complementing or substituting the charity she received.

To purse the two interesting implications, ideally we should have data for the different charities (or gifts) given to and recieved by different beneficiaries, each with different potential work efforts. Unfortunately, the available data that we are able to use here have some limitations. In particular the Family Income and Expenditure Survey (FIES) reports just one type of charity ("gift") per household in the sample. To see how this type of giving affects work efforts of the recipients, we merge the results of the 2003 round of the FIES with the results of Labor Force Survey (LFS) for the same year. The merged FIES-LFS 2003 dataset is used here to test the following hypotheses:

Hypothesis #1: The share of the total gifts in total income of the household affects the work effort of the beneficiary.

Hypothesis #2: How the gifts affects work efforts depends on whether the beneficiary work efforts substitute or complement the gift received.

5.1. The empirical model

The empirical model will test the effect of the Giver's gift *x* on the Beneficiary's work effort *y*. In the regression model below, the dependent variable y_i represents the *i*th beneficiary's work effort and x_i the value of the gifts received (from some giver).

$$y_i = \beta_0 + \beta_1 x_1 + \boldsymbol{\gamma_i x_{i2}} + \varepsilon_i$$

The proxy indicator the for dependent variable *y* is "household total hours of work per capita". The independent variable x_{i1} is "percentage share of household total value of consumption gifts (plus receipts received from local and abroad) in the households' total income". We are mainly interested in β_1 or the coefficient of the total value of gifts/transfers as a percentage of income. The variable $\boldsymbol{x_{i2}}$ is a vector of control variables representing characteristics of the beneficiary that affects her work effort. These are household per capita income and the number of family members according to classes of workers they belong. The additional paremeters to be estimated are β_0 and γ_i, while ε is the error term.

Estimation Model:

$$whrprcap = \beta_0 + \beta_1\, pgfabdm1 + \beta_3 pcapita + \beta_4 dwclass0 + \beta_5 dwclass1 + \beta_6\, dwclass2 + \beta_7 dwclass3 + \beta_8 dwclass4 + \beta_9 dwclass5 + \beta_{10}\, dwclass6 + u$$

Dependent variable:
whrprcap – household hours of work per capita in a week

Independent variables:
pgfabdm1 – percent share of the total value of gifts received to household income
pcapita – family per capita income
dwclass0 – number of family members who work for a private household
dwclass1 – number of family members who work for a private establishment
dwclass2 – number of family members who work for the government or government corporations
dwclass3 – number of family members who are self-employed without paid employee
dwclass4 – number of family members who are employers in family-operated farm or business
dwclass5 – number of family members who work with pay in own family-operated farm or business
dwclass6 – number of family members who work without pay in own family-operated farm or business

5.2. Source of data and limitations

As mentioned above, we use the merged dataset from the Philippines' 2003 Family Income and Expenditure Survey (FIES) and Labor Force Survey (LFS). Note that while the LFS dataset also includes the results of the Survey on Overseas Filipinos (SOF) conducted in the same year, the SOF data is not used or needed in this study. The survey data for 2003 is the only officially merged dataset that contains household income and expenditure (including "gifts"), and household labor information (including total hours of work) in the Philippines.

The FIES is a nationally-representative survey conducted every three years, which provides socio-economic information on Philippine households. The LFS is conducted quarterly each year. It contains information about the employment status, age, educational attainment and other work indicators of each household member. The FIES has expenditure data on food, fuel and utilities, transport and communication, household operations, house repairs and maintenance, personal care, clothing, education, medical, durable and non-durable furnishings, and other expenses. For each of these consumption items, the respondents also provide the amount of "gifts" received. The total value of these gifts is used in this study as the proxy of the Giver's gift plus the total cash receipts of assistance from domestic and abroad.

Like most empirical studies, the limitation of this study is critically defined by the data set used and described above. The most critical limitation of the study is that it did not include family members who do not have work (unemployed) and therefore were not asked in the survey about their numbers of work hours. By excluding these family members, it would appear then the study consequently excluded the poor households without work or are unemployed. However, most poor households have work or they cannot afford not to be employed. In the Philippines, poverty is correlated not with unemployment but with underemployment in the informal sectors and the agriculture sector. The other limitation is that the data set does not have data on the "Givers" as they are just proxy indicated by the value of gifts that beneficiaries received.

5.3. Empirical Data and Tests Results

The empirical model is estimated using the national sample (i.e, all beneficiary workers), and sub-samples of different groups of beneficiary workers. The first group comprises workers with per capita work hours per week less than 24 hours. The second group of workers comprises those who work between 24 and 40 hours per person per week ($24 \leq x \leq 40$). The third group of workers pertain to those who work more than 40 hours but less than 56 hours per person per week ($40<x<56$). The fourth and last group of workers comprises those who work for 56 hours or more per person per week ($x \geq 56$). We used weighted least squares method to address possible heteroskedasticity [Wooldridge 2009].

As shown in Table 4, the overall effect between hours of work with the total value of transfers received is negative except when workers work for more than 56 hours per week. This amounts to the equivalent of interpreting that we have captured the group of workers who are "altruist" workers as discussed in the theoretical framework. They work more hours sacrificing themselves for the greater good. We can identify a complementary condition since the correlation is positive: as the value of consumption gifts increases, the work hours per capita per week also increase. A potential conjecture is that the more hardworking, the more consumption gifts are received.

TABLE 4. Description of beneficiary workers according to work hours per week

	< 24 hours	**24 ≤ *x* ≤ 40**	**40 < *x* < 56**	***x* ≥ 56**	**Total**
Frequency of workers	5,914	11,958	12,169	10,510	40,551
Frequency of workers who received transfers less than or equal to 10 percent of their income	2,935	7,941	8,685	6,407	25,968
Frequency of workers who received transfers greater than 10 percent of their income	2,979	4,017	3,484	4,103	14,583
Frequency of workers in national per capita income below 5th decile.	3,327	6,004	4,746	3,976	18,053

Source: Family Income and Expenditure Survey 2003, Labor Force Survey 2003

There are 40,551 observations in the FIES-LFS 2003 dataset. Of these, there are 5,914 who worked less than 24 hours/week on average, 24,127 who worked for more between 24 hours and 56 hours per week, and there are 10,510 who worked for at least 56 hours/week. (Table 4)

The substitution condition or negative correlation (Table 5) between work hours and total gifts and transfers in workers working normally at 40 hours per week or lesser merits an explanation. Do they work less because they receive more gifts, or do they received more gifts because they work less? The substitution condition as shown in letter C in Table 1 in letter C is that it is not particular of the direction of causation. If the donor provided more than the shortfall in food requirements, then the beneficiary reduces work effort. On the other hand, the recipient can reduce work effort to generate the altruist action to increase food aid more than the shortfall in food requirements. Thus, the substitution condition means that some workers in the data worked less because they received more gifts, but some others received more gifts because they worked less. This is added explanation to the opportunity to exploit altruistic giving under conditions of substitution between the nature of assistance given and the beneficiary's effort.

TABLE 5. Test of workers in different work hours per week per capita

Dependent Variable *Work hours per week per capita*	Key Independent Variable**	Coefficient	t-value	Obs.
workers with per capita work hours per week < 24	*pgfabdm1* (% total transfers to total income)	-0.037501*	-10.45	5,914
workers with per capita work hours per week at 24 ≤ y ≤ 40	*pgfabdm1* (% total transfers to total income)	-.0273723*	-8.59	11,958
workers with per capita work hours per week at 40 < y < 56	*pgfabdm1* (% total transfers to total income)	-0.006080*	-2.31	12,169
workers with per capita work hours per week > 56 hours	*pgfabdm1* (% total transfers to total income)	.0504096*	2.12	10,362

*$p<0.10$
**Other control variables are included. Full detailed results are available from the author upon request.

We can conclude from the summary results that household total transfers (consumption gifts plus remittances) and household members' work effort are substitutes (Table 6). Thus, the Samaritan's dilemma equilibrium is implied. The charitable act of giving here involved household consumption gifts and cash receipts from domestic and abroad in a representative sample of the whole Philippine population. We have empirically shown results consistent with equilibrium outcomes different from the traditional Samaritan's dilemma. In particular, we find, evidence of high-effort workers (or "altruist" workers), an implied equilibrium outside that of the Samaritan's dilemma among high effort workers or theoretically we called as the "altruist" workers.

TABLE 6. Summary of test results

Work hours	Effects of total transfers	Complementary	Substitutes
< 24 hours	Significant	No	Yes
$24 \leq x \leq 40$	Significant	No	Yes
$40 < x < 56$	Significant	No	Yes
$x \geq 56$	Significant	Yes	No

6. Conclusion

There are two parts of the conclusion, one on theory and the other on the empirical tests. Numbers 1-2 are rom the theoretical part, and numbers 3-4 are from the empirical test.

1. On the mapping of different types of players, Buchanan's passive and active versions of the Samaritan's dilemma are confirmed. But with additional types of players, mostly among the beneficiaries, there are potential equilibria other than Buchanan's dilemma.

2. A mathematical proof in utility analysis had shown that the dilemma occurs under conditions that Samaritan's help is a substitute to the work effort of the beneficiary. The dilemma does not necessarily occur under the condition that the help given is complementary to work effort.
3. Household income transfers (consumption gifts plus remittances) are substitutes to work effort. The implied equilibrium from the empirical test is the Samaritan's dilemma of Buchanan's.
4. The Samaritan's dilemma does not occur when the beneficiary is an "altruist" worker. They are assumed to be represented by a very high effort of work in the empirical test.

This research study started with an inspiration to find an exception to the Samaritan's dilemma or moral hazard problem. In other words, the study presented a model and then sought empirical evidence that sow acts of charity inspire workers to work more. The theoretical model aptly showed that there is such a practical condition in the complementary sense. The empirical test showed that as far as income transfers or acts of charity involving household consumption items, the substitution conditions manifest the presence of a Samaritan's dilemma. High-effort workers, however, are the exception. The challenge of a follow-up study is to find data sets where the nature of charity assistance is more complementary to work effort.

Acknowledgments: I would like to thank my thesis adviser at the University of the Philippines School of Economics, Romeo Matthew T. Balanquit, Ph.D. and thesis reader, Ma. Joy V. Abrenica, Ph.D. My colleagues at the Department of Economics, ADMU: Noel P. de Guzman, Ph.D., for reviewing the manuscript, and Philip Arnold P. Tuaño, Ph.D., for encouragement and support. I also would like to thank the two anonymous referees who reviewed my work and gave valuable comments.

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The Philippine Review of Economics
57(1): 121-151. DOI: 10.37907/6ERP0202J

Forecasting residential electricity demand in the Philippines using an error correction model

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This study uses an Error Correction Model (ECM) to forecast residential electricity demand in the Philippines using household final consumption expenditure, residential electricity price, and temperature as explanatory variables. Results show that there is a long-run relationship between household final consumption expenditure and residential electricity demand. Estimates from the ECM are consistent with economic theory, and the model passed standard diagnostic and parameter stability tests. Forecast performance based on within-sample and out-of-sample forecasts of the ECM is also shown to be superior, relative to a benchmark Autoregressive Distributed Lag (ARDL) model. Simulations show that by 2040, residential electricity consumption will range from 42,500 gigawatthours (GWh) based on a weak income growth scenario and 62,000 GWh based on a combined changes scenario.

JEL classification: C22, C53, Q47
Keywords: electricity consumption, forecasting, error correction model

1. Introduction

Philippine households face the highest electricity cost in the Southeast Asian region [Ravago et al. 2016]. Policy discussion has focused on how prices can be brought down over time. Increasing generation capacity, especially those of low-cost fuel sources, is among the widely discussed proposal, but this approach must be pursued with demand targets in mind to ensure the right amount of investments in generation capacity. At the same time, meeting the emission targets must also be considered in decisions concerning the expansion of generation capacity especially that low-cost fuels tend to emit larger amounts of greenhouse gases. With all these considerations, long-run projections of total electricity consumption are critical to making the best policy choices to ensure reliable, consistent, and clean use of electricity. This paper contributes to the policy dialogue on

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generation capacity expansion by analyzing the relationships between key aggregate indicators with household electricity consumption using cointegration techniques, and by forecasting the growth of household electricity demand in the near future based on the estimated short- and long-run elasticities. It extends the work of Danao and Ducanes [2016] who used the same cointegration technique but forecasted aggregate electricity consumption rather than the consumption of a specific customer class as done in this paper.

Forecasting aggregate electricity demand would more directly guide policy discussion on generation capacity and fuel mix. However, forecasts based on aggregated heterogeneous goods strongly assume similarity in determinants and size of elasticities among specific components. In forecasting aggregate electricity demand, this is a practical concern, especially in estimating the elasticities of climactic variables. For instance, Alabbas & Nyangon [2016] found that in responsiveness to weather changes, industrial customers are not as sensitive as residential customers. By analyzing the behavior of a specific customer class, a more appropriate set of predictors can be used and ultimately, result in better forecasting performance.

This paper has two goals: first, to estimate how residential electricity consumption responds to changes in household income, prices, and temperature using an error correction model (ECM); and second, to use these estimates to forecast residential electricity demand growth under various economic and climatic scenarios. Two time-series models were compared in terms of prediction error: a simple Autoregressive Distributed Lag Model (ARDL) and an ECM. Both models stood to have relatively low forecast errors despite the limited sample size. But the ECM has a superior forecasting performance and thus, it is used to forecast long-run residential electricity demand growth under varying assumptions.

Estimates using the ECM show that residential electricity demand is influenced by short-run price and temperature changes. Household income, proxied by real household final consumption expenditure, is found to be insignificant in the short run, but a cointegration test suggests that it has a long-run equilibrium relationship with residential electricity demand. Based on the simulations, residential electricity consumption will range from 42,500 gigawatt hours (GWh) to 61,942 GWh by 2040 depending on the scenarios assumed.

This paper is organized as follows: Section 3 describes how residential electricity demand changed over time using data reported by the Department of Energy. Section 3 discusses the movement of household electricity demand and its predictors over time. Section 4 describes the data and methodology used in the empirical analysis. Section 5 discusses the estimation results. Section 6 presents the demand forecasts until 2040 under different forecast scenarios. And lastly, Section 7 concludes.

2. Review of related literature

There is a wide literature that analyzed residential electricity demand using data from developed countries. The studies can be grouped broadly into two based on the type of data used. One group of studies used household data to analyze household electricity demand using distribution utility prices and reported household income that commonly used a double-log functional form (e.g., Filippini and Pachauri [2004]; Yohanis et al. [2008]). The other group of studies used time series aggregate data, typically expressing residential electricity demand as a function of electricity prices, real incomes (real gross domestic product or real private consumption], and weather conditions. In this group, a common approach is to use an Error Correction Model (e.g., Dilaver and Hunt [2011]; Jamil and Ahmad [2011]; Zachariadis and Pashourtidou [2007]; Halicioglu [2007]; Hondroyiannis [2004]).

Jorgensen and Joutz [2012] analyzed residential electricity demand for the US Mountain Region using an Error Correction Model. The estimates were used to perform two simulations: one is to examine the impact of a ten-percent price increase and the other is to address the effect of an increase in temperature by two degrees Fahrenheit. Explanatory variables used were the real price of electricity, price of natural gas, real personal income per household, and heating and cooling degree-days. Their results show that residential electricity demand is inelastic with respect to price and income in the short run. Meanwhile, weather variables appear as a strong driver of short-run demand.

Donatos and Mergos [1991] estimated per capita residential electricity demand in Greece using a single equation model with ridge regression to overcome the presence of strong multicollinearity. Per capita residential electricity consumption is expressed as a function of private disposable income, the average price of electricity, the weighted average of heating degree days, the average price of LPG, the sales of electrical appliances, the number of consumers, and the average price of diesel. They also found that residential electricity demand is inelastic with respect to price and income, with elasticities of -0.21 and 0.53, respectively. However, they did not find a significant impact of heating degree days since diesel oil is the main energy source for space heating.

Zachariadis and Pashourtidou [2006] examined residential and commercial electricity consumption for Cyprus using an Error Correction Model. Electricity demand is expressed as a function of the lag of income and price, total degree days, and the lag of electricity demand. The error correction term included a dummy variable for the 1974-1975 period to remove the outliers in the series. They found price and income to be insignificant in the short run, and that weather fluctuation has the strongest impact on residential electricity demand.

Hondroyiannis [2004] also used an Error Correction Model to examine how residential electricity demand in Greece is affected by the real price of electricity, real income, population, and the weighted average temperature. Demand is found

to be income inelastic and unaffected by price and temperature. They also found that residential electricity demand is not characterized by a structural shift under the period of investigation, thus suggesting that the series is stable and useful for policy purposes.

In the Philippines, there are a few studies that analyzed how electricity demand is affected by various economic and climatic factors. Danao [2001] estimated a short-run model for residential electricity demand in rural areas. After households are partitioned based on their appliance portfolio, demand is estimated for each group as a function of price, annual household expenditure, and household characteristics. Weather variables are not included in the model, like in many studies on electricity demand based on cross-sectional data. His results show that demand is inelastic with respect to both price and income.

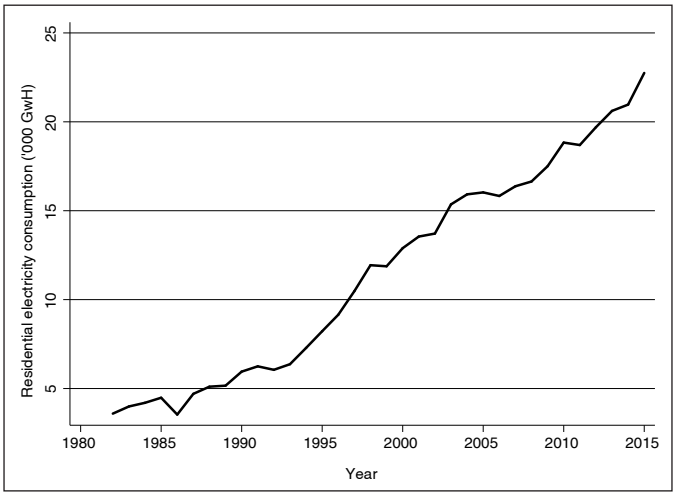
Meanwhile, Danao and Ducanes [2016] used an Error Correction Model to analyze aggregate electricity demand. They used real price, real GDP, and average temperature as explanatory variables. Their results show that aggregate electricity demand has an income elasticity of 0.94, a price elasticity of -0.13, and a temperature elasticity of 1.42. The model performed well in both within-sample and out-of-sample forecasts with a mean absolute percentage error of 1.47 percent and 0.97 percent, respectively. The estimates were then used to perform various simulations for the forecast horizon 2015-2030. By 2030, forecasts of aggregate electricity demand range from 120,000 GWh based on a five percent GDP growth scenario to 150,000 GWh based on a scenario with a seven percent GDP growth, decline in electricity prices by one percent, and increase in temperature by 0.05.

This work adopts the study of Danao and Ducanes [2016] by analyzing the relationship of residential electricity demand with real household income, real price, and temperature using an ECM. It extends the work of Danao [2001] by also analyzing residential electricity demand but using time series data, and by incorporating the effect of weather changes on short-run residential electricity demand.

3. Residential electricity demand over time

Residential demand for electricity in the Philippines has grown significantly over time. Figure 1 plots the upward movement of residential electricity demand across time. It registered an annual growth of 5.8 percent and expanded six folds from 1982 to 2015. It grew faster than commercial or industrial electricity demand, which grew at a rate of 5.7 percent and 3.3 percent, respectively. Residential customers form the largest group of electricity users in 2015, covering 27.6 percent of total electricity demand.

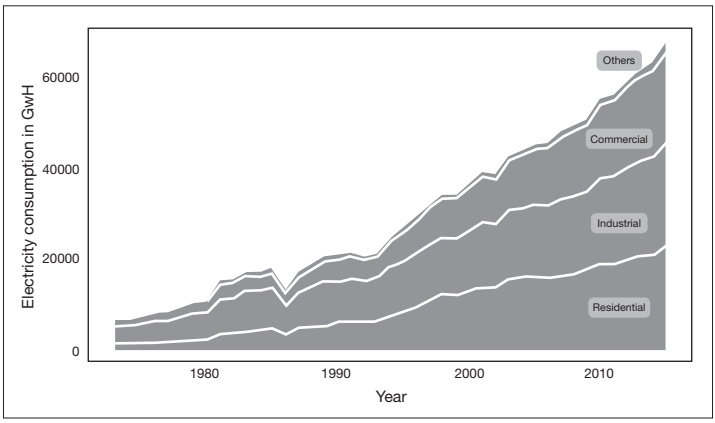
FIGURE 1. Residential electricity demand from 1982 to 2015



Source: Philippine Power Statistics, Department of Energy (DOE)

In the 1980s, demand grew at a slow rate as economic and political crises affected the power industry. A sharp depreciation of the peso made foreign obligations difficult to settle causing the projects of the National Power Corporation (NPC) to be put on hold. Financial difficulties faced by the NPC also dragged down its operational performance. Frequent load shedding occurred between 1983 and 1986 due to power system failures in the Luzon grid. While economic conditions in the 1980s improved, demand for electricity was barely matched by sufficient capacity as NPC's financial difficulties remained.

FIGURE 2. Customer shares to total electricity demand from 1982 to 2015



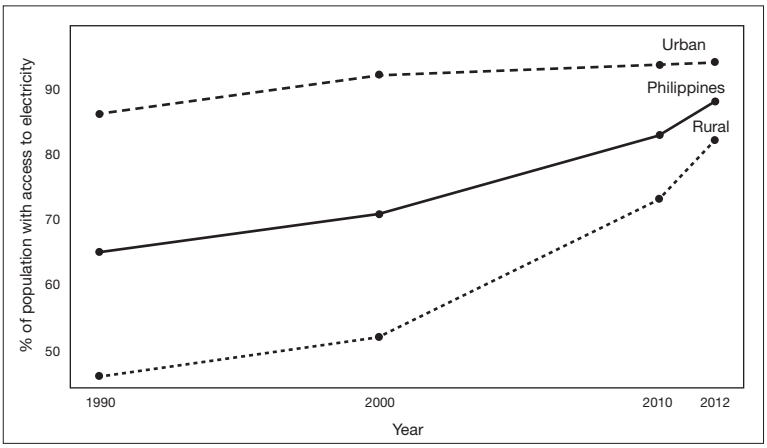
Source: Philippine Power Statistics, Department of Energy (DOE), Philippine Statistical Authority (PSA)

Growth in demand in the late 1980s was disrupted by a power crisis in the early 1990s. From 1990-1993, demand slowed down as the country faced 103 blackout days for an annual duration of 1,273 hours, equivalent to 251 GW of lost energy sales [World Bank 2003]. No new generation capacity was added in the late 1980s given the poor financial position of NPC and the expectations that Bataan Nuclear Power Plant would begin operations in 1984 to meet demand [Cham 2007]. Also, some plants are too old to produce at their installed capacity: available capacity in the Luzon grid ranged from 2,300 to 3,100 MW while installed capacity was 4,321 MW.

From 1994 to 1996, demand grew at a fast rate as the government adopted measures to expedite the creation of new generation capacity. In response to the crisis, the government passed the Power Crisis Act of 1993, which allowed the NPC to enter into "fast-track" contracts with the Independent Power Producers (IPPs) to speed up growth in generation capacity. NPC achieved a relatively stable financial position while MERALCO, the largest power distribution utility, returned to profitability. By 1996, the power sector returned to normal [Cham 2007]. Peak demand in Luzon was at 4,600 MW, while available capacity was in excess of 5,100 MW. Efforts also led to improvement in the electrification rate, which rose to 70 percent by 1996, but rural electrification remained problematic. With excess capacity, load shedding was less frequent and demand became more responsive to changes in economic conditions.

From 1997 to 2015, the NPC again suffered financial difficulties but available capacity remained sufficient to cover demand. The Asian Financial Crisis in 1997 led to a sharp depreciation of the peso that significantly increased the value of NPC's US Dollar-denominated loans, bringing back the NPC to a poor financial situation. On the other hand, the IPPs were not much affected by the Asian Financial Crisis because of the "take-or-pay" clauses in their contracts with NPC [Cham 2007]. In 2001, the government passed the Electric Power Industry Reform Act (EPIRA) which introduced changes in the structure of the power sector and privatized the assets of the NPC. On the demand side, the EPIRA strengthened the responsibility of the Small Power Utilities Group (SPUG) by connecting missionary areas to the grid [Navarro et al. 2016]. From 2000 to 2012, access to electricity in rural areas grew from 52 percent to 82 percent, as shown in Figure 3. This helped expand overall electrification from 71 percent to 88 percent over the same period.

FIGURE 3: Electrification rates over time: total, urban and rural



Source: World Bank, Sustainable Energy for All Database

4. Theoretical framework

Electricity demand is a derived demand. Consumers do not demand electricity in itself, but as an input in the production of electrical services, such as cooling, heating, lighting, and cooking. These services are produced only by supplying electrical power to an electric device. Without electricity, an electric device alone cannot produce an electrical service. And conversely, a consumer without any electric device but only electricity cannot produce an electrical service.

Jorgensen and Joutz [2012] grouped these electrical services into two. One group represents demand for daily use such as lighting, refrigeration, cleaning, and entertainment, while the other represents seasonal weather needs, such as cooling and heating. Price and income generally affect demand across electrical services, while weather conditions mostly affect demand for cooling and heating.

The reduced-form model for residential electricity consumption is formulated as follows:

$$elec=f(price,income,temperature)$$

where *elec* is residential electricity consumption, *price* is residential electricity price, *income* is household income, and *temperature* is annual temperature.

From consumer optimization theory, a demand for a good is influenced by the price of the good and the consumer's income. Assuming electricity demand is a normal good, higher electricity prices reduce demand for electrical service, and also, the demand for electricity. Meanwhile, the higher the income of the household, the higher is the demand for electricity and electrical services. The scale at which these variables can influence demand depends on the elasticity of demand with respect to these variables.

The elasticity of demand with respect to price or income is generally different in the long-run and the short-run. The long-run elasticity of demand is likely to be higher than the short-run elasticity. In the short run, a consumer has a fixed stock of appliances or electric devices that he/she can use to produce an electrical service, and thus, he/she has little room for adjustment in the event of a price or income shock.

A weather variable is also included to capture the effect of the need for electricity. In this study, the temperature is used as a weather variable[1]. The higher the temperature, the higher is the demand for cooling, and thus, the higher the demand for electricity. In the case of countries that experience hot summers and cold winters, the temperature does not have a purely positive relationship with demand. In hot summers, demand for electricity comes from cooling, while in cold winters, demand for electricity comes from heating. In the case of the Philippines that does not experience extremely cold weather conditions, the demand for electricity is expected to be positively related to temperature.

5. Data description and methodology

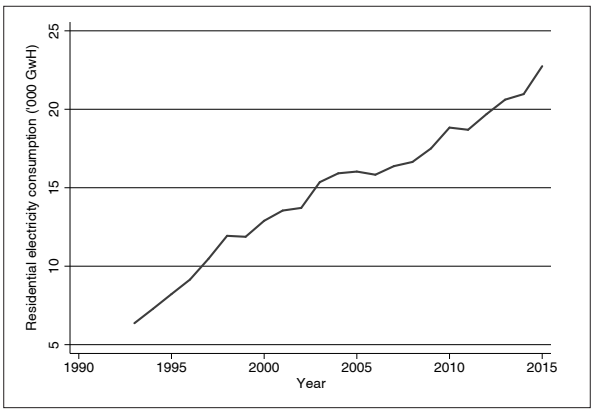
5.1. Data description

The dataset covers 23 annual observations (1993 – 2015) gathered from various sources. The original dataset covers data from 1973 to 2015 but the analysis is limited to more recent observations to avoid the issue of parameter instability, which reduces the forecasting performance of a given model [Pesaran and Timmermann 2002]. For instance, demand from the 1980s and the early 1990s was affected by poor power supply conditions that commonly resulted in load shedding. Since these conditions are no longer the same today, these observations are removed in the analysis to understand the impact of price, income, and temperature more clearly on residential electricity demand.

Residential electricity demand is measured in GWh per year. Data is taken from the Philippine Power Statistics of the Department of Energy (DOE). The Philippine Power Statistics is an annual statistical report containing disaggregated demand for electricity from areas on-grid and off-grid, total power generation mix, and peak demand per major island group. Figure 4.1 shows that residential electricity demand has been growing over time at a rate of 5.96 percent throughout the sample period (1993-2015). From 1993 to 1996, residential electricity demand grew at a faster rate of 12.84 percent as the government expedited measures to increase generation capacity.

[1] Some studies used number of heating degreee days as a weather variable (e.g., Donatos and Mergos [1991]; Hondroyiannis [2004]; Dergiades and Tsouldifis [2008])

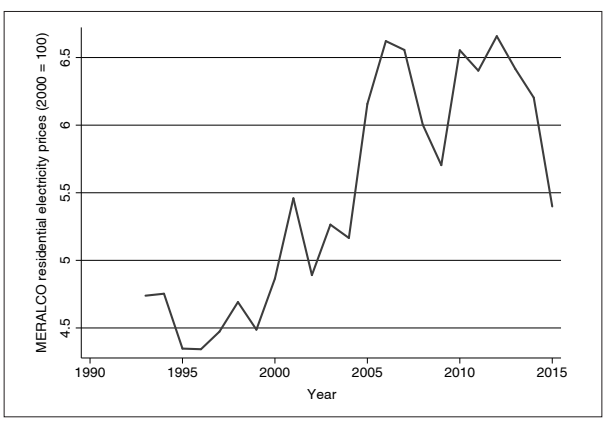
FIGURE 4.1. Residential electricity demand (1993-2015)



Source: DOE

Real residential electricity price[2] is the average annual price per kWh charged by MERALCO to its residential customers. An ideal price data is the average residential electricity price charged by various distribution utilities weighted by their corresponding market shares, but electricity sales of smaller distribution utilities and electric cooperatives are not complete. On the other hand, MERALCO is a leader in the power distribution sector with a market share of around 55 percent to 60 percent of residential electricity demand in the country [Danao and Ducanes 2016]. Real residential electricity prices grew at an average of 0.59 percent per year from 1993 to 2015. Figure 4.2 shows how real residential electricity prices move throughout the sample period.

FIGURE 4.2. Residential electricity price, constant (2000=100), (1993-2015)

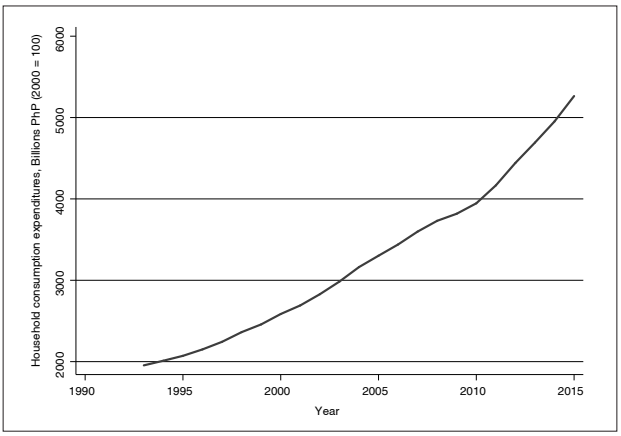


Source: MERALCO

[2] Deflated using GDP deflator (2000=100), following Danao and Ducanes [2016].

Real household final consumption expenditure (2000=100) is gathered from the Philippine Statistical Authority. As shown in Figure 4.3, it has grown steadily over time at an average annual rate of 4.61 percent throughout the sample period. Growth has been faster at around six percent from 2010- 2015.

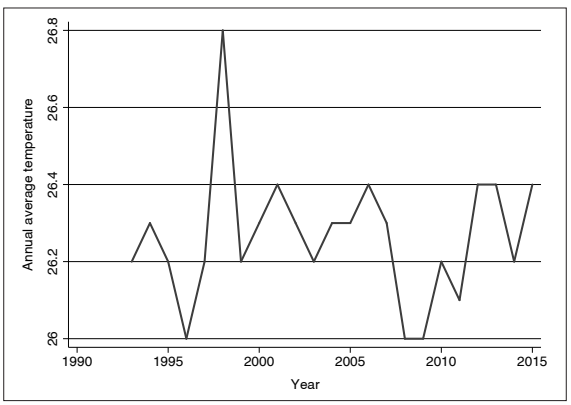
FIGURE 4.3. Household final consumption expenditure, constant (2000=100), (1993-2015)



Source: Philippine Statistical Authority

Annual temperature (in degrees Celsius) is collected from the University of East Anglia Climate Research Unit (CRU). The data is calculated by taking the simple mean of monthly average land temperatures in a given year. Figure 4.4 shows that annual average prices have been fluctuating throughout the sample period and do not display a clear trend. The average temperature is 26.27 degrees Celsius throughout the sample period as shown in Table 1, along with other summary statistics.

FIGURE 4.4. Annual average temperature (1993-2015)



Source: University of East Anglia, Climate Research Unit

TABLE 1. Summary statistics

Variable	Description	Mean	Std. Dev.	Min	Max
hhcons	Residential electricity consumption	14,812	4,535	6,368	22,747
real_price	MERALCO residential electricity prices	5.49	0.83	4.34	6.66
hhfe	Household final consumption expenditure	3,254,644	994,482	1,954,322	5,266,632
temp	Temperature (in Celcius)	26.27	0.17	26	26.80
ln_cons	log of residential electricity consumption	9.55	0.35	8.76	10.03
ln_price	log of MERALCO residential electricity prices	1.69	0.15	1.47	1.90
ln_temp	log of temperature (in Celcius)	3.27	0.01	3.26	3.29
ln_hhfe	log of household final consumption expenditure	14.95	0.31	14.49	15.48

Source: Author's calculations

5.2. Methodology

Among electricity demand studies that used time series models, cointegration models were commonly used. When the variables are cointegrated, the OLS estimator is super-consistent and allows the estimate to converge to its true value at a faster rate [Stock 1997]. Cointegration models establish the existence of a long-run equilibrium relationship tying the individual variables and therefore, "imposing this information can produce substantial improvements in forecasts over long horizons" [Stock 1997]. However, cointegration models may be used only if the variables are found to be cointegrated. If the variables are not cointegrated, a common resort is to use an ARDL model that expresses the dependent variable as a function of the explanatory variables, their respective lags, and, the lags of the dependent variable.

A common approach to test for cointegration is the Engle-Granger [1987] two-step procedure. It tests for cointegration by determining whether the linear combination of non-stationary variables is stationary. This approach entails two simple steps. The first step is to predict the residual using a standard OLS on a chosen long-run equation. The second step is to determine whether the predicted residual is stationary using unit root tests[3].

If the variables are found to be cointegrated, the ECM can be used. This model involves estimating the lag of the residual from the long-run equation. This lagged residual is also known as the error correction term. The coefficient of the error correction term must be negative to indicate that a positive short-run deviation would be corrected by a movement back towards the long-run equilibrium. The larger the coefficient, in absolute terms, the faster the dependent variable moves back to the long-run equilibrium after a short-run deviation.

[3] Common unit root tests are Dickey-Fuller test and the Philips-Perron test

Algebraically, the Error Correction Model can be derived from an ARDL equation. For example, consider the following simple ARDL model:

$$Y_t = \beta_0 + \beta_1 x_t + \beta_2 x_{t-1} + \beta_3 y_{t-1} + u_t \quad (1)$$

wherein the equation y_t is the log of residential electricity demand, expressed as a linear function of the log of household income, x_t its lags, x_{t-1}, and the lag of the dependent variable, y_{t-1}. For stability, the condition $|\beta_3| < 1$ is imposed.

The variables would reach a long-run equilibrium characterized as follows:

$$y_t = y_{t-1} \quad (2)$$

$$x_t = x_{t-1} \quad (3)$$

Plugging in these long-run equilibrium values (Equations (2) and (3) into the ARDL equation (Equation 1), the long-run demand equation is derived as follows:

$$y_t = \beta_0/(1-\beta_3) + (\beta_1 + \beta_2)x_t/(1-\beta_3) + u_t/(1-\beta_3) \quad (4)$$

In equation 4, the long-run elasticity of demand with respect to x_t is $(\beta_1 + \beta_2)/(1-\beta_3)$.

Letting $e_t = u_t/(1-\beta_3)$, Equation (4) can be rewritten as:

$$y_t = \beta_0/(1-\beta_3) + (\beta_1 + \beta_2)x_t/(1-\beta_3) + e_t \quad (5)$$

Subtracting y_{t-1} from both sides of Equation (5):

$$\Delta y_t = \beta_0/(1-\beta_3) - y_{t-1} + (\beta_1 + \beta_2)x_t/(1-\beta_3) + e_t \quad (6)$$

Adding and subtracting in the right-hand side would derive the ECM:

$$\Delta y_t = \beta_0 + \beta_1 \Delta x_t - (1-\beta_3)\left[y_{t-1} - (\beta_1 + \beta_2)x_{t-1}/(1-\beta_3)\right] + e_t \quad (7)$$

In equation (7), the short-run elasticity of demand with respect to x_t is measured by the coefficient, β_1. The term $(1-\beta_3)\left[y_{t-1} - (\beta_1 + \beta_2)x_{t-1}/(1-\beta_3)\right]$ is the error correction term that adjusts short-run demand towards the long-run equilibrium relationship following a short-run deviation. The coefficient $(1-\beta_3)$ measures the speed of adjustment.

6. Estimation results

The set of analyses below involves four steps. First, the order of integration of each variable is determined using different unit root tests, including the Augmented Dickey-Fuller Test, along with two other efficiency tests developed by Elliott, Rothenberg, and Stock [1996]. Second, a long-run equation is specified and an Engle-Granger test is used to determine the presence of a cointegrating relationship. Third, a test of weak exogeneity is conducted to determine whether a feedback mechanism exists that would necessitate the use of a Vector Autoregression (VAR) model rather than a single equation model [Enders 2015]. And lastly, an ECM equation is estimated, and standard diagnostic and parameter stability tests are conducted.

6.1. Orders of integration

A regression involving variables with different orders of integration may yield spurious results unless these variables are cointegrated. Hence, it is important to determine the order of integration of each variable using unit-root tests, of which, the most common is the Augmented Dickey-Fuller (ADF) Test. The ADF tests the null hypothesis that the series has a unit root, or integrated of order 1, or more. If a series has a unit root in levels but not in the first difference, then the variable is said to exhibit an I(1) process. If a series in levels does not have a unit root, the variable is said to exhibit an I(0) process. Alternatively, the order of integration can be determined visually using a correlogram. A correlogram shows how the variable is correlated with its own lags. A correlogram that shows a declining pattern strongly suggests non-stationarity or the presence of unit roots.

An alternative to the two-unit root tests above is taken from a family of efficient tests developed by Elliott, Rothenberg, and Stock (ERS) [1996] whose modifications improved test performance relative to an ordinary Dickey-Fuller test for series characterized with small sample size. Among the family of tests is the feasible point optimal test whose asymptotic power function is tangent to the power envelope and never far below it. A specification of this test that detrends series with intercept and trend is used as a comparison for the ADF Test. Also used is another test within the same family called the Dickey-Fuller Generalized Least Squares (DF-GLS), which modifies the ordinary Dickey-Fuller Test by transforming the series via a generalized least squares regression [ERS 1996].

Results of the ADF tests (see Table 2.1) show that the variables have different orders of integration: the log of residential electricity demand (ln_cons), the log of real price (ln_price), and the log of household final consumption expenditure (ln_hhfe) are I(1), while the log of temperature is I(0). Likewise, a visual analysis of the correlograms for these same variables (see Figures 5.1-5.8) agrees with the results of the ADF tests. These tests are then compared with the results of the feasible point optimal tests and DF-GLS tests. Results of the ADF tests are not

entirely different from those of the ADF tests with the exception of the log of residential electricity consumption variable wherein the presence of a unit root cannot be rejected. However, as the DF-GLS agrees with the ADF tests in indicating a unit root process for the log of residential electricity consumption, the first differences are used in the short-run estimations below.

TABLE 2.1. Results of the ADF and Elliott, Rothenberg, and Stock (ERS) tests

		ADF Test statistics		Feasible Optimal Test [ERS 1996] Test Statistics		DF-GLS [ERS 1996] Test Statistics	
Variable	Description	in log-levels	in 1st difference	in log-levels	in 1st difference	in log-levels	in 1st difference
ln_cons	Residential electricity consumption	-2.183	-3.468***	82.257	10.713	-1.417	-4.16***
ln_price	Residential electricity price	-1.393	-4.413***	9.755	6.555*	-1.955	-4.609***
ln_hhfe	Household consumption expenditure	2.209	-4.578***	4.70**	6.432*	-3.253**	-2.5
ln_temp	Temperature	-4.129***	-3.677***	4.07***	2.391***	-2.259	-3.15**

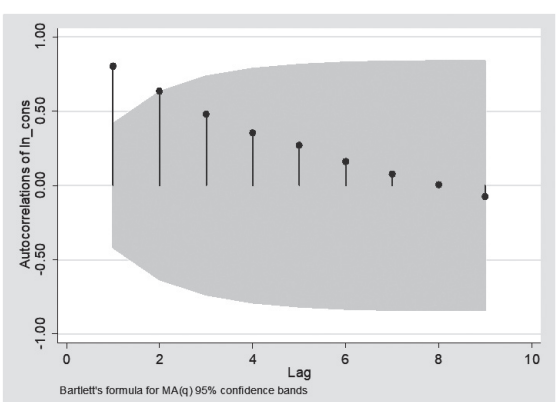
Source: Author's calculations
***p<0.01, **p<0.05, *p<0.10

TABLE 2.2. Lag specifications for the ADF and ERS tests

		ADF Test statistics		Feasible Optimal Test [ERS 1996] Test Statistics		DF-GLS [ERS 1996] Test Statistics	
Variable	Description	in log-levels	in 1st difference	in log-levels	in 1st difference	in log-levels	in 1st difference
ln_cons	Residential electricity consumption	2	0	4	4	4	0
ln_price	Residential electricity price	0	0	2	2	2	0
ln_hhfe	Household consumption expenditure	0	7	4	4	4	0
ln_temp	Temperature	0	2	4	4	4	4

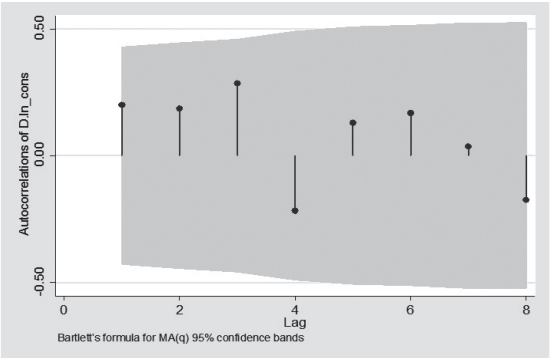
Source: Author's calculations

FIGURE 5.1. Correlogram of ln_cons



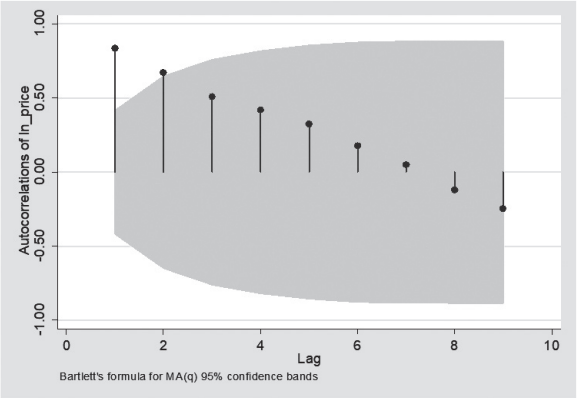
Source: Author's calculations

FIGURE 5.2. Correlogram of D.ln_cons



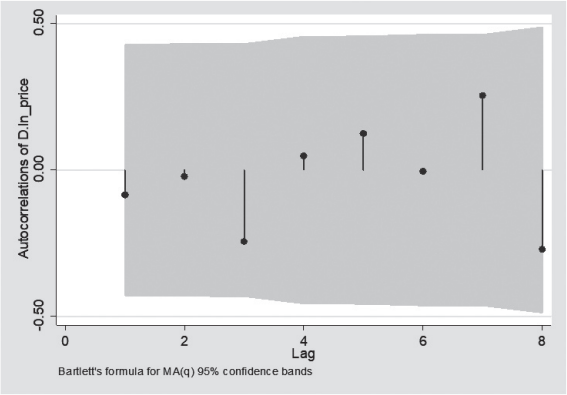
Source: Author's calculations

FIGURE 5.3. Correlogram of ln_price



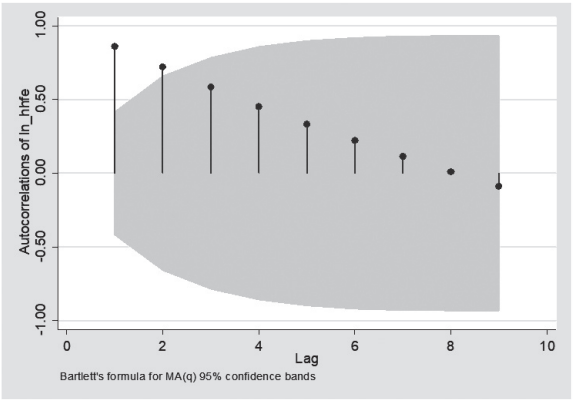
Source: Author's calculations

FIGURE 5.4. Correlogram of D.ln_price



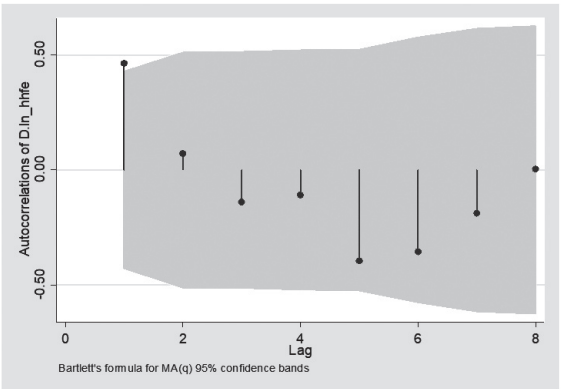
Source: Author's calculations

FIGURE 5.5. Correlogram of ln_hhfe



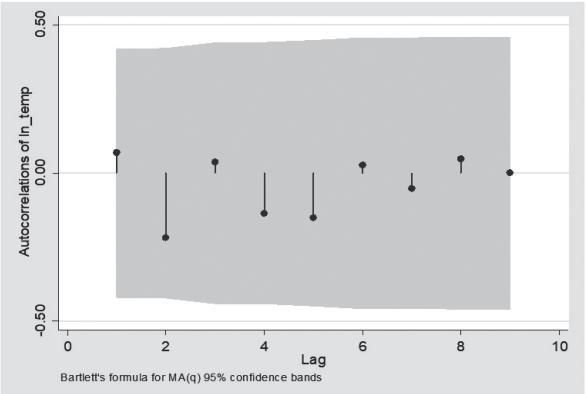
Source: Author's calculations

FIGURE 5.6. Correlogram of D.ln_hhfe



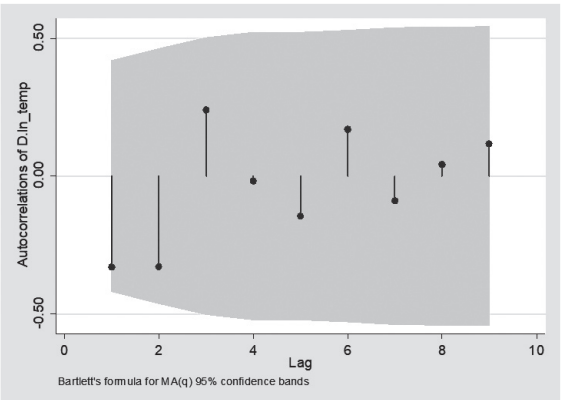
Source: Author's calculations

FIGURE 5.7. Correlogram of ln_temp



Source: Author's calculations

FIGURE 5.8. Correlogram of D.ln_temp



Source: Author's calculations

6.2. Granger Causality Test

This part of the analysis aims to understand whether bidirectional feedback exists between household expenditures and residential electricity consumption. Some studies have found that a bidirectional causality exists between economic growth and aggregate electricity consumption (e.g., Odhiambo [2009]; Bayar & Ozel [2014]). To determine whether such a feedback mechanism exists, a Granger causality test is used. If an *F*-test shows that a dependent variable can be explained by an autoregressive lagged specification of both the dependent and independent variables, then the independent variable is said to Granger-cause the dependent variable [Granger 1969]. A feedback mechanism exists if household expenditures Granger-cause residential electricity consumption, and vice versa.

The resulting *F*-tests of the model with lags of 4 are shown in Table 3 below. The resulting *F*-test is significant at the one percent significance level for the autoregressive model with the residential electricity consumption as the dependent variable; thus, suggesting that household expenditures Granger-causes residential electricity consumption. However, the reverse is not true as the lags of residential electricity consumption do not explain household expenditures. One important implication of this result is that estimating the long-run equation for the log of residential electricity consumption is unlikely to suffer from endogeneity bias.

TABLE 3. Results of the Granger causality test

Equation	Explanatory variable	*F*-statistic
ln_cons	ln_hhfe	23.05***
ln_hhfe	ln_cons	1.66

***p<0.01

Source: Author's calculations

6.3. Test for cointegration

The Engle-Granger test is used to determine whether the variables *ln_cons* and *ln_hhfe* are cointegrated. The graphs of the logs of residential electricity demand and household final consumption expenditure exhibit strong co-movement throughout the sample period (1993-2015) with a correlation of 95 percent, suggesting that these variables may be cointegrated. Equation 8 shows a model that includes a dummy variable, *dum1996* to account for the change in the movement of residential electricity demand as the power supply situation returned to normal in 1996 following the government responses to the power crisis in 1993 [Cham 2007]. Equation (8) below is estimated using OLS, then the residual is tested for stationarity based on Engle-Granger test statistics. OLS results for Equation (8) are found in Table 4 below.

$$ln\_cons_t = \alpha_0 + \alpha_1 ln\_hhfe_t + \alpha_2 dum1996 + u_t \quad (8)$$

where: ln_cons_t is the logarithm of residential electricity consumption,
ln_hhfe_t is the logarithm of household final consumption expenditure in 2000 prices,
$dum1996$ takes the value 1 if the year is 1996 or above, and 0, otherwise.

TABLE 4. OLS results of the long-run model (Equation 8)

	(1)
VARIABLES	**ln_cons**
ln_hhfe	0.878***
	(0.0502)
dum1996	0.320***
	(0.0445)
Constant	-3.850***
	(0.729)
Observations	23
R-squared	0.974

Standard errors in parentheses.
*** $p<0.01$, ** $p<0.05$, * $p<0.1$
Source: Author's calculations

The results of the Engle-Granger test (see Table 5) support the hypothesis that residential electricity consumption and household final consumption expenditure have a long-run relationship. The Engle-Granger test statistic is -4.61, rejecting the null hypothesis of no cointegration at the five percent level of significance.

TABLE 5. Result of the Engle-Granger Test

	Critical Values		
Test statistic	**1 percent**	**5 percent**	**10 percent**
-4.612	-5.014	-4.15	-3.742

Source: Author's calculations

Since the variables ln_hhfe_t and ln_cons_t are cointegrated, an ECM can be used to analyze relationships of price and income with residential electricity demand. Instead of a two-step ECM, which involves predicting the residual and using the predicted lag of the residual (i.e., u_{t-1}) as part of the short-run ARDL model, the one-step ECM is used such as the one shown in Equation (9) below. The latter estimates include the lag of the cointegrated variables: ln_cons_{t-1} and ln_hhfe_{t-1} in lieu of u_{t-1}. While unit root tests suggest that *ln_temp* is I(0), it is expressed in the first differences in the ECM for a more direct interpretation of its coefficient.

$$\Delta ln\_cons_t = \beta_1 \Delta ln\_hhfe_t + \beta_2 \Delta ln\_price_{t-1} + \beta_3 \Delta ln\_temp_t + \beta_4 ln\_hhfe_{t-1} + \beta_5 ln\_cons_{t-1} + e_t \quad (9)$$

where: Δln_cons_t is the first difference of the logarithm of residential electricity consumption,

$\beta_1 \Delta ln\_hhfe_t$ is the first difference of the logarithm of household final consumption expenditure in 2000 prices,

Δln_price_{t-1} is the lag of the first difference of the logarithm of real residential electricity price,

Δln_temp_t is the first difference of the logarithm of temperature,

ln_hhfe_{t-1} is the lag of the logarithm of household final consumption expenditure in 2000 prices,

ln_cons_{t-1} is the lag of the logarithm of residential electricity consumption

6.4. Test of weak exogeneity

In a single-equation ECM, it is important that the cointegrating vector is unique[4] and the explanatory right-hand side variables are weakly exogenous [Harris 1995]. A variable is said to be weakly exogenous if its marginal distribution contains no useful information for conducting inference on a parameter set (Engle et al. [1983]; Enders (2015)]. If the variables are weakly exogenous, a single-equation ECM (as shown in Equation (9)) can be used to analyze relationships. Each of the variables used in the right-hand side of the short-run model is regressed on the lagged residual, and then, a *t*-test is performed on the variable, u_{t-1}. Results (see Table 6) show that none of the variables is significant at the five percent level, suggesting that the variables are weakly exogenous. This satisfies the requirement of Harris [1995] in the use of single-equation ECM.

Table 6. Results of the test of weak exogeneity

Test of weak exogeneity	D.ln_hhfe	D.L.ln_price	D.ln_temp
L.uhat	0.03	0.35	0.04
p-value	0.14	0.07	0.32

Source: Author's calculations

[4] By definition, a single explanatory variable in the long-run model means that the cointegrating vector is already unique.

6.5. Results of the ECM and the ARDL

Estimates of the ECM are consistent with economic theory (see Table 7, model 1) and passed standard diagnostic tests (see Table 8, model 1). The first column of Table 6 shows the estimates using the ECM. First, price and household final consumption expenditure have a negative and a positive effect on household electricity demand, respectively. Estimated short-run price elasticity is -0.26, while short-run income elasticity is 0.75, although not significant at the ten percent level. Second, the estimated long-run elasticity[5] is 1.75, higher than the short-run elasticity estimate. This suggests that households do not immediately adjust to income shocks until they are able to adjust appliance stock in the long-run. Third, the temperature has an elasticity of 2.2 indicates that demand is highly elastic with respect to changes in temperature. High-temperature levels trigger households to use cooling appliances, such as an air conditioner, which typically consumes a large amount of electricity. The model also passed the parameter stability test, as the graph of the CUSUM-squared test (see Figure 6.1) is within five percent bandwidth of significance.

TABLE 7. Results of the ECM and the ARDL

	(ECM)	(ARDL)
VARIABLES	**D.ln_cons**	**D.ln_cons**
D.ln_hhfe	0.754	-0.582
	(0.438)	(0.764)
LD.ln_price	-0.264***	-0.329***
	(0.0570)	(0.102)
D.ln_temp	2.206***	2.587***
	(0.456)	(0.878)
L.ln_cons	-0.206***	
	(0.0517)	
L.ln_hhfe	0.118**	
	(0.0540)	
Constant	0.237	0.0847**
	(0.361)	(0.0356)
Observations	21	21
R-squared	0.893	0.545

Standard errors in parentheses.
*** $p<0.01$, ** $p<0.05$, * $p<0.1$
Source: Author's calculations

[5] Long-run income elasticity is calculated by dividing the coefficient of L.ln_cons by the coefficient of L.ln_hhfe. This calculation is based on Equation (7) in the Theoretical Framework.

TABLE 8. Standard diagnostic test results (*p*-values)

Diagnostic tests	Model 1 (ECM)	Model 2 (ARDL)
RAMSEY Reset Test	0.961	0.560
Test for Heteroskedasticity	0.441	0.099
Breusch-Godfrey Test for serial correlation	0.241	0.025
Jarque-Bera normality test	0.260	0.260

Source: Author's calculations

For comparison, the following ARDL model (Equation (10)) is also estimated:

$$\Delta ln\_cons_t = \beta_1 \Delta ln\_hhfe_t + \beta_2 \Delta ln\_price_{t-1} + \beta_3 \Delta ln\_temp_t + e_t \qquad (10)$$

where: Δln_cons_t is the first difference of the logarithm of residential electricity consumption

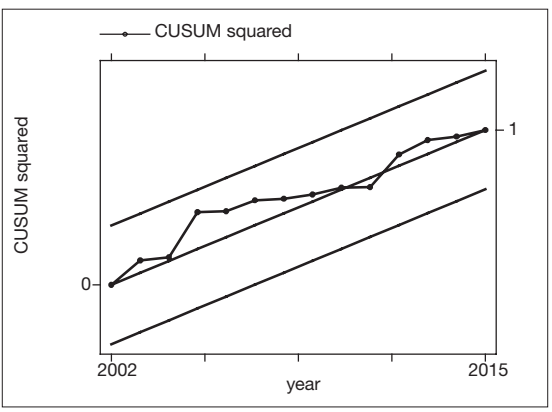
$\beta_1 \Delta ln\_hhfe_t$ is the first difference of the logarithm of household final consumption expenditure in 2000 prices

Δln_price_{t-1} is the lag of the first difference of the logarithm of real residential electricity price

Δln_temp_t is the first difference of the logarithm of temperature

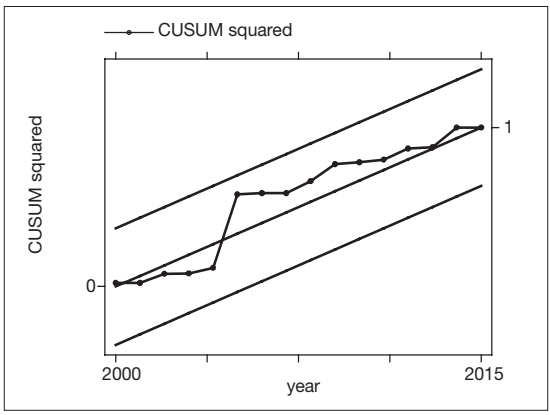
Results for the ARDL are found in the second column of Table 7. The only difference of the ARDL model from the ECM is the exclusion of the error correction term. The price elasticity is -0.33 and the temperature elasticity is 2.59. On the other hand, income elasticity is not significantly different from zero and has a negative sign, a result also found by Jorgensen and Joutz [2012]. The model generally passed standard diagnostic tests (see Table 8, model 2), except for the Breusch-Godfrey test indicating the presence of serial correlation. Also, the graph of the CUSUM-squared test (see Figure 6.2) is within the five percent bandwidth, which means the parameters are stable.

FIGURE 6.1. Parameter stability test for ECM (CUSUM Test)



Source: Author's calculations

FIGURE 6.2. Parameter stability test for ARDL (CUSUM Test)



Source: Author's calculations

6.6. Forecasting performance

The forecast accuracy of the two models is compared using the Mean Absolute Percentage Error (MAPE) of both in-sample and out-of-sample forecasts, with a hold-out period from 2012 to 2015. The MAPE is calculated by taking the absolute value of the difference between the actual and forecast values as a fraction of the actual value. The forecasting performance of the ECM is superior to that of the simple ARDL. For the ECM, the out-of-sample MAPE is 6.32 percent while the within-sample MAPE is 1.13 percent. In contrast, for the ARDL model, the out-of-sample and within-sample MAPEs are higher at 2.38 percent and 9.19 percent, respectively. The graphs comparing actual and forecasted values for residential electricity consumption for the estimated period are shown in Figure 7.1 for ECM and Figure 7.3 for ARDL. The graphs of the out-of-sample forecasts for ECM are in Figure 7.2 and for ARDL in Figure 7.4.

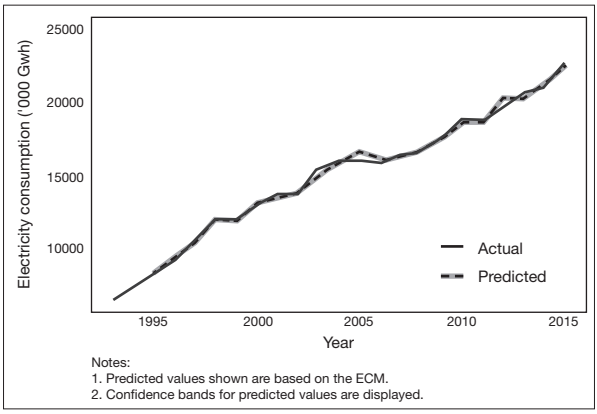
TABLE 9. Mean absolute percentage error of estimates from ECM and ARDL

ECM: Mean Absolute Percentage Error (MAPE)	
in-sample	1.13 percent
out-of-sample	6.32 percent

ARDL: Mean Absolute Percentage Error (MAPE)	
in-sample	2.38 percent
out-of-sample	9.19 percent

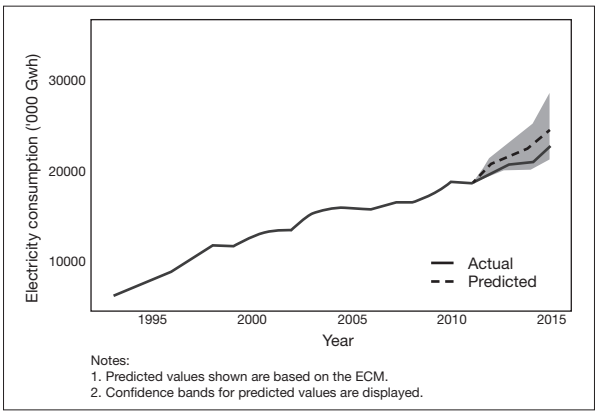
Source: Author's calculations

FIGURE 7.1. Comparison of actual and within-sample forecasts using ECM



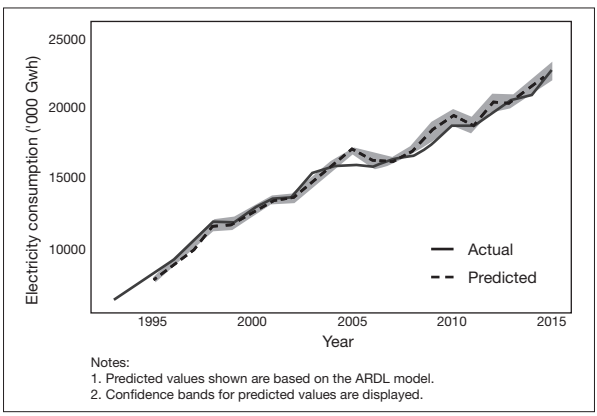
Source: Author's calculations

FIGURE 7.2. Comparison of actual and out-of-sample forecasts using ECM



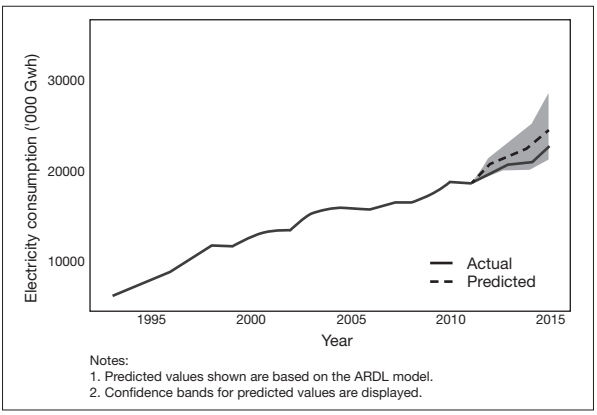
Source: Author's calculation

FIGURE 7.3. Comparison of actual and within-sample forecasts using the ARDL



Source: Author's calculations

FIGURE 7.4. Comparison of actual and out-of-sample forecasts using the ARDL



Source: Author's calculations

7. Scenario analysis

The Error Correction Model is used to forecast residential electricity demand from 2016 to 2040. The ECM has a better forecasting performance than the alternative short-run ARDL model, it passed standard diagnostic and parameter stability tests, and has elasticity estimates consistent with economic theory.

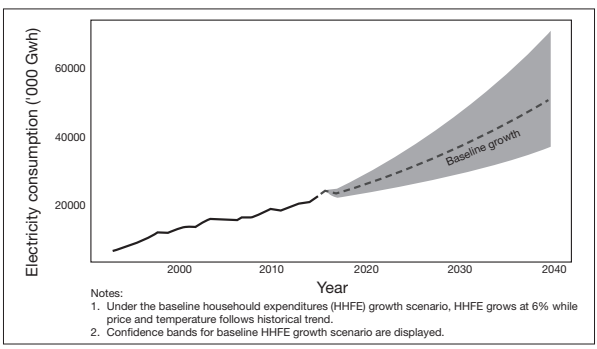
There are six scenarios used to forecast long-term residential electricity demand, as adopted from the scenarios used by Danao and Ducanes [2016]. All the scenarios assume a GDP growth rate of six percent per year. The first three scenarios assume different growth rates for household final consumption expenditures HHFE while assuming that the other explanatory variables follow historical trends, i.e., the predicted values using the time variable as a regressor. The three scenarios are the following: (1) the baseline scenario wherein HHFE grows at an annual rate of six percent (also the average growth from 2011-2015); (2) the strong growth scenario wherein HHFE grows at an annual rate of seven percent; (3) the weak growth scenario or non-consumption-driven growth wherein real GDP growth of six percent is driven by growth of total real GDP less real household final consumption expenditure (i.e., I+G+NX) growing at 8 percent, with an implied growth rate of 4.7 percent. The fourth scenario assumes that temperature follows historical trend, real HHFE grows at six percent, while household electricity price falls by one percent per year. The fifth scenario assumes temperature will increase by 0.05 per year[6], while price follows the historical trend and real HHFE grows at an average of six percent. And lastly, the sixth scenario is the combined growth scenario which assumes that the price will fall by one percent, the temperature will increase by 0.05, and real HHFE will grow by seven percent per year.

[6] This figure is based on the study of Cinco, et al. [2013] that projects temperature in the Philippines to increase by 0.9 and 1.1 from 2000 to 2020. The annual average increase in temperature using the midpoint projection of 1.0 is 0.05

7.1. Impact of growth in Household Final Consumption Expenditure (HHFE)

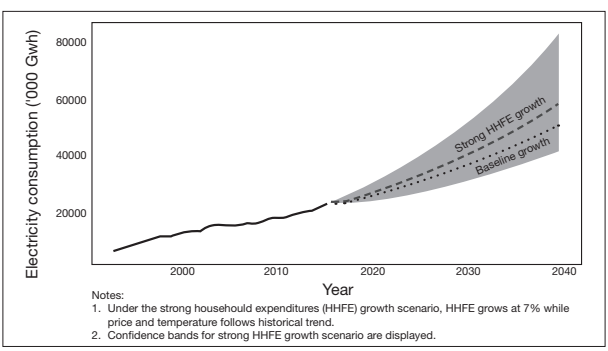
Higher growth of HHFE results in higher growth of residential electricity demand in the future. The baseline scenario assumes HHFE growth of six percent per year, the strong growth scenario assumes HHFE growth of seven percent, while the weak growth scenario assumes that the six percent assumed growth in real GDP is driven by eight percent growth in components other than consumption, i.e., (I+G+NX), while HHFE grows at only 4.7 percent. Under the baseline scenario, residential electricity demand will grow at 3.20 percent per year, while the weak consumption and strong consumption growth scenarios yield an annual average residential electricity demand growth of 2.43 percent and 3.78 percent, respectively. By 2040, residential electricity demand under the weak growth scenario is 17.04 percent lower than the baseline forecast while that under the strong growth scenario is 15.28 percent higher than the baseline forecast. Figure 8.1 compares the forecasts for each growth scenario.

FIGURE 8.1. Simulations based on the baseline growth scenario (in GWh)



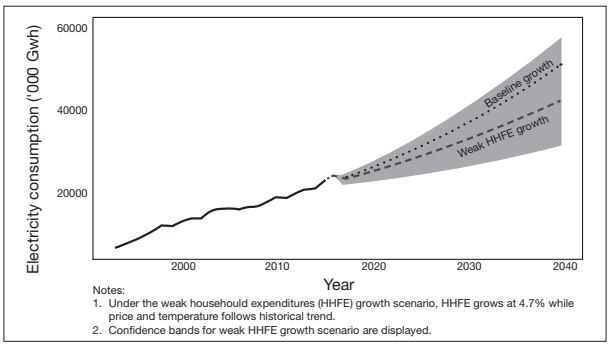
Source: Author's calculations

FIGURE 8.2. Simulations based on the strong growth scenario (in GWh)



Source: Author's calculations

FIGURE 8.3. Simulations based on the weak growth scenario (in GWh)



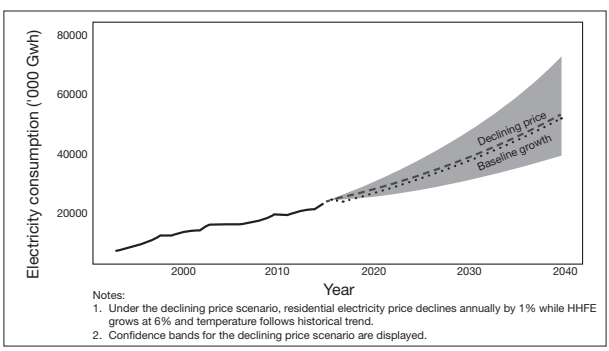
Notes:
1. Under the weak household expenditures (HHFE) growth scenario, HHFE grows at 4.7% while price and temperature follows historical trend.
2. Confidence bands for weak HHFE growth scenario are displayed.

Source: Author's calculations

7.2. Impact of a price decline

Declining residential electricity prices result in higher growth of residential electricity demand in the future. This scenario assumes a decline in residential electricity prices by one percent per year, an increase in temperature following the historical trend, and an HHFE growth of six percent per year. From 2016 to 2040, residential electricity demand will grow at 3.31 percent per annum, and by 2040, residential electricity demand will reach 52,689 GWh, higher than the baseline scenario by only 2.85 percent. The minimal increase relative to the baseline scenario is expected considering the low-price elasticity of residential electricity demand, in absolute terms. Figure 8.4 compares the forecasts between baseline HHFE growth and the price decline scenario.

FIGURE 8.4. Simulations based on the declining price scenario (in GWh)



Notes:
1. Under the declining price scenario, residential electricity price declines annually by 1% while HHFE grows at 6% and temperature follows historical trend.
2. Confidence bands for the declining price scenario are displayed.

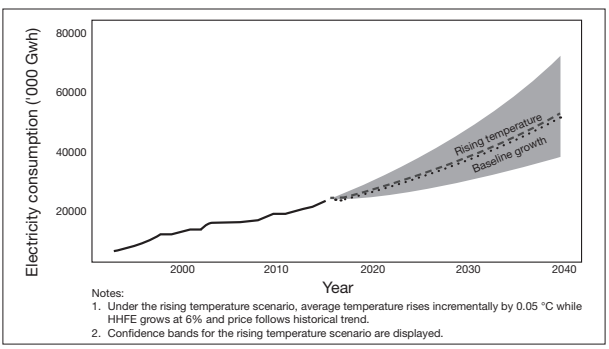
Source: Author's calculations

7.3. Impact of increasing temperature

Increasing temperatures result in higher growth of residential electricity demand in the future. This scenario assumes a uniform increase in temperature by 0.05 per year based on projections by Cinco, et al [2013], an increase in electricity

prices following the historical trend, and a growth of HHFE by six percent per year. From 2016-2040, residential electricity demand will grow at 3.22 percent per annum, and by 2040, residential electricity demand will reach 52,243 GWh, higher than the baseline scenario by 1.98 percent. Figure 8.5 compares the forecasts between baseline HHFE growth and the increasing temperature scenario.

FIGURE 8.5. Simulations based on rising temperature scenario (in GWh)

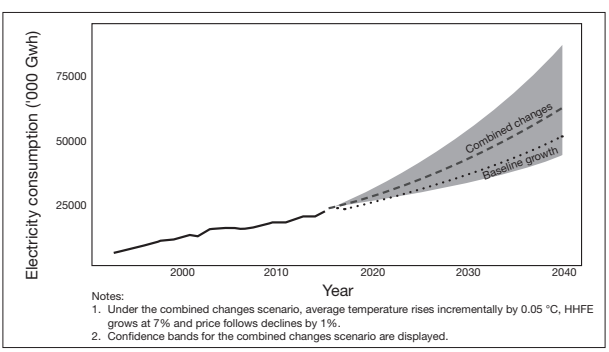


Source: Author's calculations

7.4. Impact of combined changes in the explanatory variables

Among the scenarios adopted in this paper, this scenario yields the highest forecast of residential electricity demand. This scenario assumes growth in HHFE by seven percent, a decline in residential electricity prices by one percent, and a uniform increase in temperature by 0.05 per year. From 2016-2040, residential electricity demand will grow at 3.91 percent per annum, and by 2040, residential electricity demand will reach 61,942 GWh, higher than the baseline scenario by 20.91 percent. Figure 8.6 compares the forecasts between baseline HHFE growth and the combined changes scenario.

FIGURE 8.6. Simulations based on combined changes scenario (in GWh)



Source: Author's calculations

TABLE 10. Summary of forecasts under various scenarios

Scenario	Assumptions on variables	2030 (in GWh)	2040 (in GWh)
Baseline growth	HHFE annual growth: 6 percent Price: historical trend Temp: historical trend	36,648	51,230
Strong growth	HHFE annual growth: 7 percent Price: historical trend Temp: historical trend	40,036	59,060
Weak growth	GDP growth of 6 percent and non-consumption growth (I+G+NX) of 8 percent Price: historical trend Temp: historical trend	33,251	42,500
Price decline	GDP annual growth: 6 percent Price: decline by 1 percent per year Temp: historical trend	37,811	52,689
Temperature increase	GDP annual growth: 6 percent Price: historical trend Temp: increase by 0.05 per year	37,380	52,243
Combined changes	GDP annual growth: 7 percent Price: decline by 1 percent per year Temp: increase by 0.05 per year	42,132	61,942

Source: Author's calculations

8. Conclusion

This paper analyzed how residential electricity consumption responds to changes in income, price, and temperature using an ECM. The forecast performance of the ECM is superior to that of the ARDL based on historical simulations. Estimates were used to forecast residential electricity demand until 2040 using various scenarios adopted from Danao and Ducanes [2016].

The estimates satisfied various conditions that are important in using an ECM. The logs of residential electricity demand, price, and household final consumption expenditure are integrated of order 1, while the log of temperature is integrated of order zero. The variables are transformed into first differences so that the ECM involved variables with the same order of integration. The Engle-Granger test showed that the log of residential electricity demand is cointegrated with the log of household final consumption expenditure. Also, evidence of weak exogeneity is found in the explanatory variables.

Estimates show that demand responds negatively to prices, positively to income and temperature. Long-run elasticity for real household final consumption expenditure is larger than in the short run since households can adjust the stock of appliances in the long-run and thus, be more responsive to changes in income. Meanwhile, the short-run estimates for price and income fall within the

bounds reported in the meta-analysis of Espey and Espey [2004]. Each of the models passed standard diagnostic and parameter stability tests. The forecasting performance of the ECM for long-run simulations is better than the ARDL. Despite the limited sample size used in estimating the elasticities, the out-of-sample predictions were highly accurate.

Scenario analysis provides a range of possible values of long-term residential electricity demand. The simulations are compared to that of the baseline six percent growth in household final consumption expenditure. By 2040, the weak growth scenario provides the most conservative forecast, lower by 17 percent than the baseline scenario, while the combined changes scenario provides the most aggressive forecast, higher by around 21 percent than the baseline scenario. The strong household consumption growth scenario also provides a high forecast considering the fairly high long-run elasticity of demand with respect to income.

Future research can extend this work by using alternative techniques to estimate demand elasticities. For instance, in testing for cointegration, it would be worth exploring how the results would be different using an ARDL-bounds test. Also, using a longer time series data that examines structural breaks would likely increase the degrees of freedom and improve the quality of estimates. Along with the forecasts for residential consumption, forecasting industrial and commercial consumption are also important for policymakers. These customer groups have dynamics separate from what is analyzed in this paper. Future works that investigate consumption behavior from these customer groups are recommended.

These results are useful to guide policymakers in determining the size of future expansion in generation capacity to ensure that future electricity demand is adequately met. The Philippines has experienced situations in the past wherein generation capacity was not able to meet demand leading to frequent load shedding. Policymakers need to ensure that such situations are prevented from occurring in the long-term. Thus, it is critical for energy policy planners to have an accurate estimate of electricity demand growth over time.

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The Philippine Review of Economics
57(1): 152-187. DOI: 10.37907/7ERP0202J

Then and now: analyzing Filipino youth education and work decisions following the K-12 basic education reform

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This research aims to analyze the trends in youth education and work outcomes before and after the implementation of the kindergarten to grade 12 (K-12) Basic Education Reform, focusing on three broad outcomes: (1) in education, (2) in employment, or (3) not in employment, education or training (NEET). It determines certain characteristics associated with each of these outcomes by employing multinomial logistic regression analysis. The study finds that although the overall likelihood of being in education has increased after the reform, certain groups, particularly disadvantaged ones, still have higher probabilities of being in employment or NEET rather than continuing their education. Furthermore, after the reform, young men from disadvantaged groups have a higher probability of being NEET. Albeit minimal, this merits investigation and monitoring in the future, as it may worsen inequalities.

JEL classification: I21, I24, J13, J21
Keywords: youth labor market, youth school-to-work transition, education reform, youth not in education, employment, or training

1. Background and introduction

The kindergarten to grade 12 (K-12) Basic Education Reform in the Philippines was passed into law in 2013, effectively extending compulsory education and updating the curriculum. The two main objectives of the law are to ensure that students graduating from senior high school will be employable and to make them more prepared for higher education studies. In other words, the reform promises better opportunities for K-12 graduates, thereby making education a worthwhile investment. Were the promises of the reform enough to incentivize the youth to choose education instead of dropping out? Furthermore, if they drop out from school, are they employed, or do they become youth who are not in employment, education, or training (NEET)?

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The study of NEETs is gaining traction in the literature because of the economic and societal implications of this phenomenon (Lewis et al. [1998]; Ling and O'Brien [2013]; Maguire [2015]; Naafs [2013]). There are costs to being NEET, as evidence shows. Youths in NEETs are penalized in the future for lacking education and employment experience (Gregg and Tominey [2005]; Krahn and Chow [2016]). They are also likely to engage in substance abuse and have poorer health conditions (Bania et al. [2019]; Furlong [2006]; Gutiérrez-García et al. [2018]; Ling and O'Brien [2013]; Maguire [2015]). These conditions lead to stigma that can result in their disassociation with society [Bynner and Parsons 2002]. In other words, being NEET sets up the conditions for further inequalities in income, health, and other issues that allow poverty and inequity to prevail in society.

Unfortunately, there is not enough research on NEETs in the Philippines, including the magnitude of their presence nationwide and their socioeconomic profiles. This is despite the recognition of *istambay,* alluding to a Filipino youth who does nothing and is associated with negative concepts, such as idleness and laziness [Batan 2012].

This study has the objectives of (1) examining Filipino youth outcomes in the recent decade in light of the K-12 Basic Education Reform, and (2) probing the overlooked outcome of being NEET. Specifically, this research seeks to know if there is an increase in the propensity of the Filipino youths to choose schooling, instead of employment or becoming NEET. It is also interested in determining the socioeconomic and demographic characteristics associated with each outcome.

In line with the objectives outlined above, the following questions guide this research:

1. What are the trends in Filipino youth education-work decisions—being in employment, in education, or NEET—in the years 2010 to 2019?
2. How are socioeconomic and demographics characteristics associated with the different youth decisions? Are there pervading inequalities?
3. Was there a structural change[1] in the education-work decision trends following the reform? Was the change similar across socio-economic groups or are there differences?

2. Theory and literature review

It is important to investigate the underlying factors that may influence youth decisions and outcomes. These factors are best identified and analyzed by studying the different theories and frameworks that influence decisions relating to education and work, especially for the youth. Furthermore, to contextualize the analysis, studies that relate sociocultural and historical perspectives with youth decisions and outcomes are surveyed, in the Philippines or in countries that share similar characteristics.

[1] By structural change, this means a discernible change in the trend (or patterns) in terms of work and education outcomes starting 2016, which marks the start of the K-12 Basic Education Reform.

2.1. Human capital theory

One dominant framework linking education and work outcomes is the human capital theory. In this framework, increased skills and competencies, acquired through schooling and work experience, are remunerated with higher wages or income (Becker [1962]; Mincer [1958]). However, indirect and direct costs and benefits are taken into account, especially opportunity costs or the benefits that will be foregone should the individual spend time in school rather than on other activities such as work. Those who go to school now forego the opportunity to earn money at present but have a higher trajectory of earnings in the future as compared to those who do not (Harmon et al. [2003]; Psacharopoulos and Patrinos [2004]). Thus, the rational decision for an individual is to spend on education, making schooling an investment.

2.2. Transition to adulthood and the life course theory

Young people in their 'transition to adulthood' make life choices that include education and work, as well as marriage and family life (Modell et al. [1976]; Neugarten and Datan [1973]). The transition to adulthood is a crucial part of the individual's life stages. This is being studied under the Life Course theory, which is an interdisciplinary field of study that brings in approaches and perspectives from the disciplines of sociology, psychology, biology, economics, anthropology, and history, as well as fields of study such as demography, epidemiology, criminology, and health and policy sciences (Bernardi et al. [2019]; Elder et al. [2003]). The Life Course theory sees the behavior of individuals as dynamic. They act and decide given a specific juncture in their lives, and these choices add up leading to certain outcomes in the future [Elder 1994]. As such, it is important to note the turning points of the youths in their transition to adulthood, as their choices will have repercussions on their next life stages [Elder 1998].

Scholars argue that in these turning points young people construct their life choices based on how they see themselves in the future or their aspirations (Hart [2016]; Hart and Sriprakash [2017]; Naafs [2013]). However, youth aspirations alone do not determine the outcomes—the role of families, in particular the parents, are crucial. The outcomes thus may also be reflective of the aspirations of the parents themselves. Therefore, there is the question of how much control or agency the youth has in making decisions (Elder [1994]; Evans [2007]).

Emerging research in the Global South has revealed that while modern neoliberal and western values of individual success are being integrated into these societies—due to globalization and industrialization—young people are bound by local customs, traditions, and cultural ideologies such as gender roles, filial obligations, and strong community ties (Alipio [2013]; Skelton [2012]; Yeung and Alipio [2013]). Furthermore, also among countries in the Global South, there are variations due to the diversity of values, social and political institutions, and economic development.

Specifically, in the Philippines, many social norms govern family and community relations, which in turn might affect young people's decisions concerning education, work, and plans. One of them is '*pakikipagkapwa'* (reliance on others) and another is its cousin, '*utang na loob*' (debt of gratitude) (Kaut [1961]; Marcelino [1990]; Reyes [2015]; Tuason [2008]). The latter is a system of contractual obligations that cause individuals to be perpetually tied to repaying the gratitude from family members or community members [Kaut 1961]. This includes the filial obligation of children to their parents, and the expectation to provide support to parents and siblings once they have the capacity to do so. Some studies in the Philippines have documented how young people link their aspirations and individual decision-making with the perceived obligation to study for employment, and eventually supporting the schooling of other siblings (Aldaba et al. [2004]; Camacho [1999]; Torres [1982]). Thus, youth decision-making largely anchors on family dynamics in the Filipino society, either through acknowledgment of parental authority or through their values of putting family first. This debt of gratitude also extends to members of the community that have provided assistance in times of need—in which case the receiver of assistance should be prepared to return the favor. However, Kaut [1961] claims that this system victimizes the poor, and aggravates power imbalances in the society by trapping impoverished people in a cycle of debt. In some ways, it could even affect aspirations. A qualitative study in the Philippines on people who have been born into poverty has found that those who remained poor expressed that *"*they are better off without ambitions*"* for fear of greater obligations [Tuason 2008:165]. As found in this study, these people believed that ambitions are for the rich or those with wealthy relatives and that being born into poverty is a God-given fate, consistent with the religious teachings of the Catholic faith—the predominant religion in the Philippines. This suggests that social norms and institutions could affect aspirations and in turn decisions of the youth. Moreover, it raises the question of whether the state of the youth (i.e., being in education, working, or neither) is less of an individual decision and more of an uncontrollable outcome brought by these various forces.

Nonetheless, most people in developing countries like the Philippines generally see education as a means to securing employment, which is part of the societal expectations of young people in their transition to adulthood (Naafs and Skelton [2018]; Yeung and Alipio [2013]). Even in rural areas, where there is a lack of opportunities and more traditional views on gender roles, the value of education is factored in the strategy and aspirations, both by the young person and the family (Estudillo et al. [2001]; Naafs and Skelton [2018]; Quisumbing and McNiven [2005]; Urich and Gultiano [2005]). Estudillo et al. [2001] find that household decisions in terms of investment differ between sons and daughters in rural areas, especially if the household possesses the land. Families tend to give land to their sons, and invest in the schooling of their daughters [Estudillo et al. 2001]. However, for landless families, both male and female children generally tend to engage in wage labor (Sakellariou and Lall [2000]; Urich and Gultiano, [2005]). Nonetheless,

young women in rural areas do not stay long in their households; either they marry or migrate to other areas once they reach a certain age [Pomeroy 1987]. Unmarried young women, especially those under 30 years of age, are likely to migrate to urban areas in search of better opportunities (Gultiano and Xenos [2006]; Khoo et al. [1984]; Quisumbing and McNiven [2005]). This urbanward migration—in order to study or work and send remittances to their families—is part of their ambition or the family's strategy of survival, as documented by various qualitative studies surveying different rural areas in the country (Camacho [1999]; Gultiano and Xenos [2006]; D. V. Hart [1971]; Trager [1984]; Urich and Gultiano [2005]). This reflects societal perceptions about girls, including the increasing reliance of parents on their daughters rather than their sons to '*study conscientiously, keep stable jobs, and provide more consistent support in their old age*' [Paqueo and Orbeta 2019:3]. This has contributed to the so-called 'feminization' of urban migration in the Philippines (Gultiano and Xenos [2006]; D. V. Hart [1971]). Evidence supports this, as a study documents migrant daughters being more likely than sons to remit to their families [Gultiano and Xeno 2006]. Yet, the work opportunities for female migrants are limited, especially for those less educated, as they tend to work as domestic helpers, if not in low-paying jobs in the services sector [Gultiano and Xenos 2006]. Interestingly, studies find that when females do migrate to urban areas, they also tend to delay marriage (Camacho [1999]; Gultiano and Xenos [2006]; Hendershot [1971]; Trager [1984]). These studies provide insights on young females' decisions in their transition to adulthood, such as education, work, and marriage.

2.3. Youth not in employment, education, or training

The reality is that aspirations do not always translate to outcomes. Some of the reasons point to labor supply often exceeding labor demand [Manacorda et al. 2017]; education not translating to sufficient skills needed by the industry [Gropello et al. 2010] due to coordination failure between the academe and the industry [Orbeta 2002]; or the labor markets are simply inefficient due to information asymmetry [Lockwood 1991], with labor market incentives penalizing young people and favoring older and more experienced workers [Caroleo et al. 2017]. Thus, many young people face the problems of unemployment, marginalization, and further inequality, resulting in disillusionment or stasis (Heissler [2011]; Naafs and Skelton [2018]).

This may lead to the phenomenon of youth not in education, employment, or training (NEET). The group of NEETs is composed of two types: (1) young people who are available for work and are actively seeking employment (i.e., unemployed); and (2) those who are not available or not seeking work. The reasons for being NEET could likewise vary. Some may lack the resources to navigate the transitions or exercise choice, while others who are more privileged

and able to exercise a significant degree of choice, may decide for themselves [Furlong 2006]. Being NEET is associated with negative long-term outcomes. Young people who are NEETs now may potentially be trapped in a cycle of unemployment, if not suffer 'wage scarring', a situation wherein their future wages will be much lower than their counterparts who have not been NEET in their youth (Gregg and Tominey [2005]; Krahn and Chow [2016]). They also tend to engage in riskier activities (e.g. crimes, substance abuse), have poorer physical and mental health, and are associated with higher mortality rates (Bania et al. [2019]; Furlong [2006]; Gutiérrez-García et al. [2018]; Ling and O'Brien [2013]; Maguire [2015]). The society also has a negative perception of NEETs because of this, which leads to further marginalization [Bynner and Parsons 2002]. Some scholars argue that the accumulation of resentment and disengagement may lead to political extremism [Thurlby-Campbell and Bell 2015].

But who are these NEETs? Are they really from disadvantaged groups? Current evidence from other countries such as Mexico [Levison et al. 2001], United States [Gustman and Steinmeier 1981], and United Kingdom [Zuccotti and O'Reilly 2019] indicate that youth unemployment is associated with certain marginalized ethnicities and lower socioeconomic status. In some cases, the reason for being NEET is due to gender roles, with women more likely to be NEET due to homemaking duties and early marriage (Gutiérrez-García et al. [2018]; Levison et al. [2001]). In the Philippines, traditional roles of girls and boys in terms of contribution to the household remain in some parts of the country—girls help their mothers in housekeeping duties, while boys help their fathers in providing income (Pomeroy [1987]; Sakellariou and Lall [2000]). Notably, however, the Philippine literature also provides evidence of investment and attention to girls' education and employment opportunities (Camacho [1999]; Gultiano and Xenos [2006]; Paqueo and Orbeta [2019]; Urich and Gultiano [2005]). Thus, it is interesting to see which views dominate in relation to girls' education and work outcomes, especially in a modernizing Filipino society.

Unfortunately, there is not enough research providing evidence on the profile of NEETs in the Philippines, including the magnitude of their presence nationwide. Clarence Batan [2012; 2015], one of the few researchers that study Filipino youth NEETs through ethnographic approaches in selected communities in the country as well as a nationwide survey on young people conducted in 2002[2], has observed that the phenomenon may not be limited to a particular socioeconomic class, although the poor are more vulnerable. Meanwhile, quantitative studies that take advantage of nationwide datasets in the country have given much attention to the school-work trade-off or the binary distinction of in-school versus out-of-school youth, which leaves plenty of room to analyze this segment of the youth.

[2] The Young Adult Fertility and Sexuality (YAFS) Study is a series of national surveys on the Filipino youth aged 15 to 24.

2.4. Summary

The decisions of young people may go beyond the cost-benefit valuation of schooling. External factors may be influential, such as the family and the community, in their decision-making. The environment likewise plays a role, such as governing laws, publicly-provided services like safety nets, education and labor market systems, socio-cultural values, traditions, and other societal characteristics. Thus, this study will attempt to draw from the reviewed evidence in constructing the analytical framework and in analyzing the results.

3. Methodology

3.1. Scope of the study

In view of the changes in the education system, the analysis will focus on a specific sub-group of the population—those aged 16 to 19 years old—who are most affected. It is important to note that this study does not track the individuals after the reform happened. Rather, it compares the young people aged 16 to 19 years before the reform (2010–2015) and their counterparts, also aged 16 to 19 years, after the reform (2016–2019). Assuming the education system remains the same, the hypothesis is that the education-work decisions of this group will remain the same across time. Therefore, all else held constant, the change in the education system due to the reform is hypothesized to cause a structural change in the trend in terms of work and education outcomes. This change should occur starting 2016, marking the start of the K-12 Basic Education Reform. Given the differential effects of the reform, the group is further disaggregated as follows.

- Group A: Young people aged 16-17 years are directly affected by the reform. Prior to the reform, they should have already completed compulsory education. After the reform, they are required to take two more years of secondary school.
- Group B: Young people aged 18-19 years should ideally have completed secondary education before and after the reform, and therefore face the more compelling decision trade-off between (tertiary) education and employment. Given the reform's promise that basic education is enough to endow them with employable skills, there is the question of whether indeed they have chosen to forego tertiary education and instead participate in the labor market.

This study has several limitations. First, it is not an impact evaluation, but rather a form of process evaluation, in which the results are indicative of future trends, and therefore could be treated as inputs to policy changes. It does not attempt to make causal claims, but rather looks at associated changes in youth decisions and outcomes before and after the K-12 Basic Education Reform has

been implemented. Second, because of data availability, the post-reform period included in the analysis consists of three years. Therefore, it may be too early to tell if indeed the change in the trend is 'structural' in nature, such that the new trend will hold in the future. Third, as this study draws from secondary data, the limitations on the depth and breadth of what the data can demonstrate are acknowledged. Hence, where possible, information from relevant quantitative and qualitative studies will supplement the analysis. Lastly, this study does not differentiate the effects between public and private education. The reform mandates both public and private institutions to conform with the K-12 structure. Therefore, relative costs between public and private institutions do not necessarily change as they are all expected to extend their levels. Furthermore, even if there have been some changes due to the overall increase in the cost of schooling, substitution effects between public and private education are hard to test because of the lack of data.

Nonetheless, the contribution of this research extends to two important objectives: (1) filling the gap in the literature about NEETs in the Philippines within the context of education policy, and (2) providing preliminary analysis following the adoption of the reform.

3.2. Data and methods

This study makes use of the Labor Force Survey dataset spanning the years 2010 to 2019. The Labor Force Survey is an official, nationally representative household survey conducted quarterly by the Philippine Statistics Authority (PSA). This research uses only the results of the third-quarter survey of each year, conducted in July, to reduce seasonality effects. This period is selected because the academic year of most primary and secondary schools starts in June, and it is also the latest available data for the year 2019 at the time the research is conducted.[3] Each survey data is combined to create a pooled cross-section dataset. On average, each annual survey has 200,000 nationally representative individual respondents. When pooled together, the dataset contains a total sample of approximately 1.9 million respondents. Narrowing it down to include only the group 16-19 years of age, the total sample size is reduced to 161,974. In estimating the regression model, the total sample size is reduced to further 160,391 as observations were dropped due to incomplete information on all the variables (Table 1).

[3] There are some primary and secondary schools that start their academic calendar in August, and these are usually private and international schools. However, more and more basic education schools are likely to shift their academic calendars to August as some universities and colleges are likewise doing the same in recent years.

TABLE 1. Data Sample

Year	16-17 yrs	18-19 yrs	Total
2010	8,846	8,212	17,058
2011	8,858	8,177	17,035
2012	9,078	8,291	17,369
2013	9,018	8,538	17,556
2014	8,664	8,076	16,740
2015	8,802	8,565	17,367
2016	7,280	6,885	14,165
2017	7,469	6,783	14,252
2018	7,446	7,137	14,583
2019	7,287	6,979	14,266
Total	82,748	77,643	160,391

Source of raw data: Labor Force Surveys (various years). Author's calculations.

This study has two levels of analysis. First is the descriptive analysis, which looks at trends in youth outcomes. This specifically answers the first research question. To answer the two remaining questions, which aim to link the socioeconomic and demographic profiles of youth with the outcomes, multinomial logistic regression is employed. This method will be able to estimate the likelihood of observable characteristics to be associated with a particular outcome—that is, in education, in employment, or neither. Available information such as demographic characteristics and socioeconomic characteristics will be drawn from the survey data. Survey weights are used to derive nationally-representative estimates. Relevant quantitative and qualitative literature, particularly ethnographic studies on youth based in the Philippines or other similar developing countries, will supplement the discussion of results and interpretation of the findings.

4. Analytical framework

4.1. Background of the K-12 basic education reform

The K-12 Basic Education Reform effectively extends compulsory schooling to include Grades 11 or 12, which are known as Senior High School (SHS). Prior to the reform, there is no prescribed starting age, although most children enter basic education at six or seven years old. Figure 1 illustrates the changes and the starting age given the different education levels, based on the following provisions of the K-12 Basic Education Reform Act:

> "Elementary education refers to the second stage of compulsory basic education which is composed of six (6) years. The entrant age to this level is typically six (6) years old.

> "Secondary education refers to the third stage of compulsory basic education. It consists of four (4) years of junior high school education and two (2) years of senior high school education. The entrant age to the junior and senior high school levels are typically twelve (12) and sixteen (16) years old, respectively".

FIGURE 1. Appropriate school ages by education level, before and after the reform

Age	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Pre-reform			Elementary						Secondary				Tech-Voc or Higher Education					
			Gr 1	Gr 2	Gr 3	Gr 4	Gr 5	Gr 6	Yr 1	Yr 2	Yr 3	Yr 4	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5*	
Post-reform		K	Elementary						Secondary						Tech-Voc or Higher Education			
		K	Gr 1	Gr 2	Gr 3	Gr 4	Gr 5	Gr 6	Gr 7	Gr 8	Gr 9	Gr 10	Gr 11	Gr 12	Yr 1	Yr 2	Yr 3	Yr 4*

*Some higher education programs have one year more than the others, such as engineering. While Tech-Vocation and higher education are not compulsory, they are included here for illustration purposes. Post-baccalaureate studies are not included.

There is some flexibility in the starting age—the law does not provide any penalties if the child enters school at a later age. In other words, even if the law states that the age of entry in Grade 1 is six years old, a child at seven or eight or even nine years could enter, and they (or their parents) will not be penalized. However, the Department of Education has been strict with younger entrants. With the release of a Department Order in 2018 (DO 3, series of 2018), only children who have reached the age of five years by the end of August of that academic year will be allowed to enroll in kindergarten. As for Grade 1 entrants, only those who have (1) completed Kindergarten, or have proof of their capacities to enter the school through an assessment; and (2) have reached six years of age are eligible. Therefore, Figure 1 is a useful illustration of the changes in the expected educational attainment of school-aged children (5–21 years old) before and after the reform.

While the reform presents itself as a curriculum upgrade, the change in the education structure through the two additional years in secondary school could affect the decisions of a certain group of population—in particular, those who are 16 to 19 years of age. Prior to the reform, some would have already graduated from high school, and therefore are faced with the options of either proceeding to tertiary education (technical vocation or higher education) or participating in the labor market full-time. After the reform, they face a different set of options: (1) continue to Senior High School and then proceed to tertiary education; (2) continue to Senior High School and then participate in the labor market full-time; (3) join the labor market full-time; or (4) not be employed nor in education. Given this, the focus of the analysis will be on this group of youth, and the trends in their outcomes concerning education and work.

4.2. Framework of analysis

The first step is to present descriptive analysis, by looking at the trends in youth outcomes across time. Observing the trends is crucial in establishing discernible breaks in the patterns, especially after the reform has been implemented.

The second step involves setting up the regression model for the pooled cross-sectional analysis (Equation (1)). Y_{itr} represents the outcome of the *i*th individual given year *t* and region *r*. It is hypothesized that the intervention variable (*reform*)—a dummy variable equal to one if the individual is in the post-reform period (2016–2019) and 0 if in the pre-reform period (2010–2015)—is significantly correlated with the changes in the outcomes, thus yielding coefficient β. $\boldsymbol{X}$ is the vector of covariates, which include individual and household characteristics. Regional fixed effects (δ_r) are controlled. ε_{itr} represents the error term, which is assumed to be randomly distributed across observations.

$$Y_{itr} = \alpha + \beta_{it}\, reform_{itr} + \boldsymbol{\gamma'} \boldsymbol{X}_{itr} + \delta_r + \varepsilon_{itr} \qquad (1)$$

Because the outcomes are categorical and not necessarily ordered, the model cannot be estimated using ordinary least squares. As with limited dependent variables, maximum likelihood estimation through is employed to evaluate choice probabilities among outcomes. Specifically, multinomial logistic regression is utilized to estimate the probability that the young person chooses one of these four categories: 1) NEET, 2) employed, 3) in secondary education, or 4) in tertiary education.[4]

The model in Equation (1) is re-specified in Equations (2.1) to (2.3), where three outcomes are separately regressed against a reference outcome or a pivot point (K). Let $\boldsymbol{\theta}$ be the vector of coefficients and $\boldsymbol{C}$ as the vector of all explanatory variables in Equation (1). Thus, the results yield three sets of regression estimates, expressed in log odds, which are transformed to odds ratios (through exponentiation) and consequently, to average marginal effects for ease of interpretation. Thereafter, predicted probabilities are computed to illustrate the results of the estimation.

$$\log \frac{\Pr(Y_{itr} = 1)}{\Pr(Y_{itr} = K)} = \boldsymbol{\theta_1} * \boldsymbol{C}_{itr} \qquad (2.1)$$

$$\log \frac{\Pr(Y_{itr} = 2)}{\Pr(Y_{itr} = K)} = \boldsymbol{\theta_2} * \boldsymbol{C}_{itr} \qquad (2.2)$$

$$\log \frac{\Pr(Y_{itr} = 3)}{\Pr(Y_{itr} = K)} = \boldsymbol{\theta_3} * \boldsymbol{C}_{itr} \qquad (2.3)$$

[4] The multinomial logistic regression banks on the assumption of the independence of irrelevant alternatives (IIA). This means that choosing one category over the other should not depend on the presence or absence of other categories.

Because of data constraints, the model is unable to include certain variables not present in the Labor Force Survey. Therefore, there may be issues relating to omitted variable bias. The following information from the Labor Force Survey will be used in the regression analysis (Table 2).

TABLE 2. Multinomial regression analysis, independent and dependent variables

	Variable	Variable type	Description
Dependent	Decision	Categorical (Nominal)	Outcome status = 1, NEET = 2, Employed (not studying) = 3, In secondary education = 4, In tertiary education
Independent	Post-reform period	Categorical (Binary)	Dummy variable indicating period when K-12 reform is being implemented = 1, survey year = 2016 to 2019, if Group A = 1, survey year = 2018 to 2019, if Group B = 0, survey year = 2010 to 2015, if Group A = 0, survey year = 2010 to 2017, if Group B
	Female	Categorical (Binary)	= 1, female = 0, male
	Urban	Categorical (Binary)	= 1, located in urban area = 0, located in rural area
	Married	Categorical (Binary)	Civil status = 1, married or have been married/ separated = 0, single
	Household size	Continuous	Number of members in the same household = [1,35]
	Educational attainment of household head	Categorical (Ordinal)	Highest education level reached by the household head = 0, no education = 1, primary education = 2, secondary education = 3, tertiary education
	Interaction: Reform*Sex	Categorical (Binary)	Dummy variable interacting reform period and sex
	Interaction: Reform*Urban	Categorical (Binary)	Dummy variable interacting reform period and location
	Interaction: Reform*HH head	Categorical (Binary)	Dummy variable interacting reform period and level of education of household head
	Interaction: Female*Urban	Categorical (Binary)	Dummy variable interacting female and location
	Interaction: female*married	Categorical (Binary)	Dummy variable interacting female and civil status
Fixed effects	Regional variables	Categorical (Binary)	Dummy variables of all regions except NCR (National Capital Region as the reference) to control for regional variations

The model has five independent variables that refer to the different characteristics relating to the individual and household characteristics. These include sex, location, civil status, parental education, and household size.

The sex variable is of particular interest because of the competing views coming from traditional gender roles and from an increasingly modernized society that recognizes the value of investing in girls. Should traditional values prevail, it is hypothesized that girls are most likely to be NEET, given their expected roles in the household. On the other hand, if modernization has become more dominant, then girls would be less likely to be NEET and more likely to be in school.

The location is interesting because of the divide between rural and urban areas in terms of opportunities. Urban areas are likely to offer economic opportunities that allow employment, and they also tend to have better infrastructure that facilitates access to education. Thus, it will be interesting to determine which outcome dominates, holding everything else fixed. On the flip side, rural areas offer fewer economic opportunities and infrastructure. Thus, this model will test the hypothesis that young people here are more likely to be NEET.

A young person's civil status may also affect his/her work or education decision. On the one hand, there is more pressure to seek employment to finance household needs, especially if there is a child that needs support. However, this may also be confounded by gendered roles. Girls will likely become NEETs to take care of the child, while boys will be in charge of finding the resources. However, it may also not be the case due to evolving values on these roles, and the availability of support coming from parents. Holding all else constant, it would be interesting to find the respective probabilities of being NEET, employed, or even in school for married young people.

Meanwhile, as seen in the literature review, studies in the Philippines found that the parents' or the household head's education is a strong predictor of youth schooling or work, due to its relationship with resource availability in the household, capturing the transmission and conversion of economic capital, as well as the intergenerational transmission of aspirations.

Finally, household size is included to determine the relationship of a large household on youth decisions. It is hypothesized that having more members of the family stretches household resources, thereby compelling young people to contribute to the household, either through employment or household production. This is especially because of family dynamics and expected filial obligations of children, which have been found in the literature as strong determinants of youth decisions.

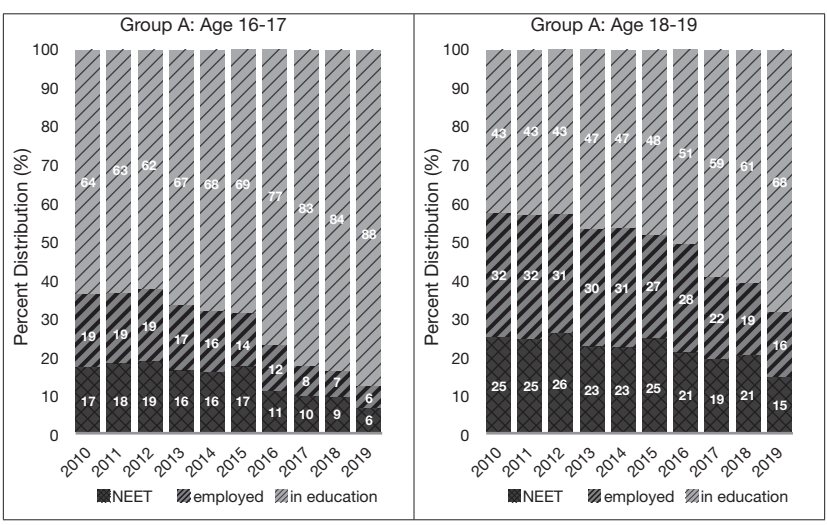
The regression model also includes an independent variable indicating the time period—that is, whether the youth is in the period before or after the reform. In including this variable, this study tests the hypothesis that the changes in the education system through education reform are associated with changes in youth decisions as well as youth outcomes. It should be noted that the two sample groups have different pre-reform and post-reform periods because the timing of the effects differs. The effects of the reform on Group A are observed in 2016, at the start of the implementation. Meanwhile, the effects on Group B are observed from 2018.

Additionally, interactions to recognize the interplay of factors based on the literature review, such as (a) sex and location, and (b) sex and civil status are included. Furthermore, the model includes the interaction of the individual characteristics with the reform variable to determine if there are any associated changes in the relationships between these characteristics and outcomes following the reform's implementation. In doing so, the study assesses whether inequality in life outcomes has widened or narrowed following the reform. Finally, regional variables are included as fixed effects, leaving the biggest and most economically active region (National Capital Region) as the reference, to control for unobserved variation across regions. This takes into account the variations in terms of the level of economic development, opportunities, cultural differences (as the Philippine peninsula is diversified in terms of language and culture), and other structural differences.

5. Results and analysis

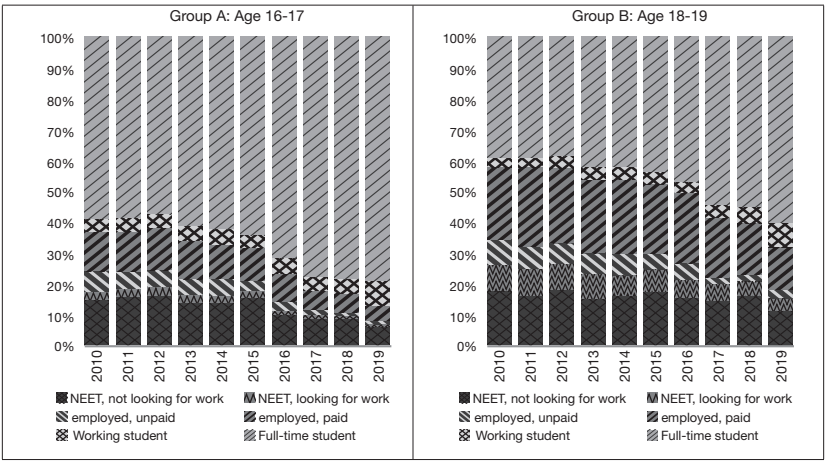
Across the ages 16 to 19, there is a rising trend in the share of those in education, indicating youth decisions favoring education (Figure 2). There are, however, differences between the group of 16–17 years old (Group A) and the group of 18–19 years old (Group B). First, the older group (Group B) shows higher proportions of NEET. Second, the timing of when the effects of the reforms are largely observed varies between age groups. The changes in the younger group started in 2016, while the older group felt the effects as early as 2017. This is expected since the reform affects the first group at the start of the implementation, and then as the same cohort advances the next year, the effect is carried over. Furthermore, the changes in Group B are even more dramatic in 2019. Disaggregating these categories, there are more NEETs not looking for work than those actively seeking employment (Figure 3).

FIGURE 2. Youth school-work outcomes, 2010-2019



NEET = Not in education, employment, or training.
Source of raw data: Labor Force Surveys (various years). Author's calculations.

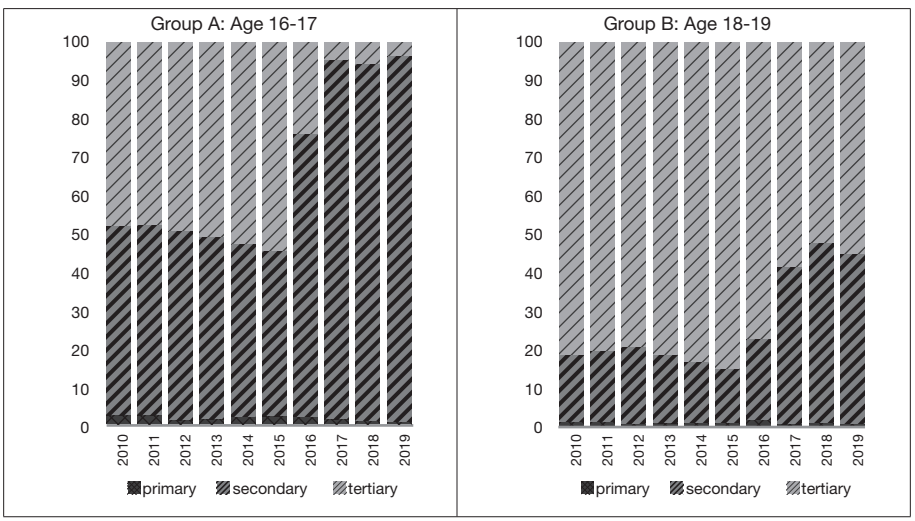
FIGURE 3. Youth school-work outcomes, disaggregated



NEET = Not in education, employment, or training.
Note: Unpaid work includes those who are working in family enterprises and excludes housekeeping duties.
Source of raw data: Labor Force Surveys (various years). Author's calculations.

Those enrolled have varying levels of education, and some are not at the education level ideal for their age. For example, about 20 percent of young people aged 18–19 years are still in secondary level between the years 2010 and 2015 (Figure 4). These trends suggest that either children are not entering school at the right age or there have been instances of delays and repetition that hinder the child to progress.

FIGURE 4. In education: current level of study

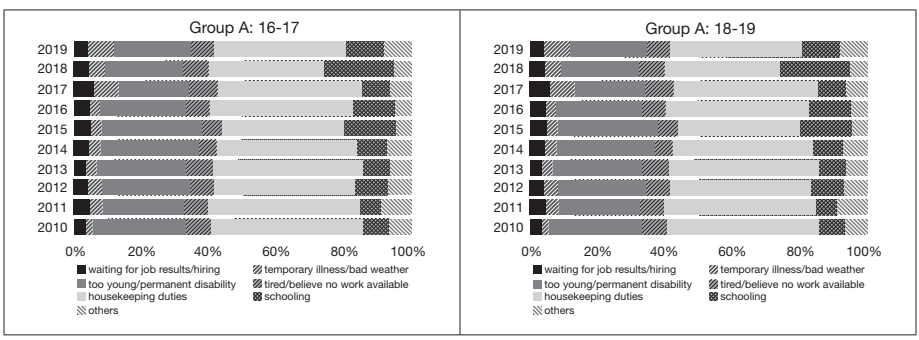


Source of raw data: Labor Force Surveys (various years). Author's calculations.

The significant rise in the share of studying in secondary education for those 18–19 years of age, especially in 2017 indicates that despite being over-aged, they have been incentivized to enroll in basic education. However, another policy may have caused this shift. In 2017, the government began subsidizing tuition fees in publicly-funded colleges and universities and worked towards the development of a law to institutionalize this policy. In 2018, the Universal Access to Quality Tertiary Education Act was passed, which not only made public tertiary education institutions tuition-free but also included financial support for those studying in private tertiary education institutions. Because of this law, there are more incentives to complete basic education and proceed to tertiary education. Therefore, the enactment of this policy possibly confounds the effects of the K-12 reform. Unfortunately, due to the timing of the implementation of these reforms and the limitations of the Labor Force Survey, disentangling their respective effects is not feasible.

Being NEET does not necessarily mean inactivity. Both age groups cited household duties as the main reason for opting out of the labor force (Figure 5). Housekeeping duties require time and effort, equivalent to a day's work, and could even be valued more than the income earned by the household head [Gronau 1980]. A cross-tabulation of the reasons by gender (not shown here) reveals that in the sample, the number of females citing housekeeping as the reason for being NEET is three times larger than males.

FIGURE 5. NEET: Top reasons for not looking for work



Source of raw data: Labor Force Surveys (various years). Author's calculations.

There are no significant shifts in patterns before or after the reform, suggesting that the same reasons for these NEETs have endured despite changes in the education structure. Unfortunately, the survey does not ask why they are not in education. Therefore, it is difficult to make a general claim that the reasons why they do not look for work could be applied to why they do not choose to continue their studies. The direction of causation is also not definitive—perhaps they have chosen to discontinue their studies, so they are doing household duties instead.

Studies in the Philippines have looked closely at the reasons why children drop out of education using different household survey data. These studies find that the top reason for dropping out is due to lack of personal interest (Albert et al. [2012]; David et al. [2018]), and not because they need to work. In fact, only ten % of the surveyed respondents have cited employment as their reason for dropping out. Thus, it is important to find out the reasons why students are losing interest in education. One can speculate a number of reasons based on the literature studying other countries, albeit needing validation in the Philippine context. One, young people might have been demotivated to study because of school-related factors, including quality of teaching and the student's persistent disappointing performance in school [Frostad et al. 2015)]. Another could be due to "unsociability and conflict at school" [Momo et al. 2019: 20]. This could be investigated further in a separate study, drawing from a more holistic approach using mixed methods research that takes aspirations into account.

5.1. Regression analysis

The trends in recent years, especially after the reform, indicate that more and more young people are choosing to be in education, and less so in employment. Still, some are in less desirable outcomes, the NEETs. Thus, the regression analysis seeks to answer the questions: (1) who are likely to be in education, in employment, or NEET? And (2), after the reform, have there been changes?

Table 3 provides the statistical summary of the data and the variables used in the regression analysis. The dependent variable is the outcome of the youth, and the independent variables are the socioeconomic and demographic characteristics of the youth and his/her household.

TABLE 3. Summary statistics of variables

Variable	Group A: 16-17 yrs	Group B: 18-19 yrs
Observations (N)	82,748	77,643
DEPENDENT VARIABLE		
Pre-reform status (distribution, %)		
(1) NEET	17.6%	23.5%
(2) Employed	17.5%	29.2%
(3) in Secondary Education	31.5%	10.2%
(4) in Tertiary Education	33.5%	37.0%
Post-reform status (distribution, %)		
(1) NEET	9.2%	17.9%
(2) Employed	8.2%	17.7%
(3) in Secondary Education	75.1%	29.5%
(4) in Tertiary Education	7.5%	34.9%
INDEPENDENT VARIABLES		
Individual characteristics		
Sex (distribution, %)		
Male	51.2%	50.9%
Female	48.8%	49.1%

TABLE 3. Summary statistics of variables (continued)

Variable	Group A: 16-17 yrs	Group B: 18-19 yrs
Location (distribution, %)		
Urban	44.3%	46.7%
Rural	55.7%	53.3%
Civil Status (distribution, %)		
Single	97.6%	91.2%
Married (or have been married)	2.4%	8.8%
Household characteristics		
Highest level reached by Household Head (distribution, %)		
no education	2.5%	2.4%
primary	38.9%	37.9%
secondary	37.4%	37.6%
tertiary	21.1%	22.1%
Household Size, Average	6.2	6.2

Note: Group A post-reform period: 2016 to 2019; Group B post-reform period: 2018-2019

5.2. Characteristics significantly associated with the outcomes

The results of the multinomial regression, through average marginal effects, are presented in Table 4 and Table 5 for Group A and Group B, respectively.[5] The coefficients are interpreted as the associated change in the probabilities of being in a particular outcome, given a unit change in the predictor, holding all other factors fixed. The results of the multinomial regression are transformed to predicted probabilities (Tables 6 and 7), which is useful in drawing out the effects of interacting variables (e.g., interaction of location-sex, civil status-sex, etc.) on the likelihood of being in any of these outcomes. In interpreting the predicted probabilities, the study only looks at the statistically significant predictors and their interactions, based on the results of the odds ratios.[6] The following discussions summarize the findings of the characteristics associated with the different outcomes.

Based on the results of the average marginal effects (Tables 4 and 5), young females tend to be NEET more than their male counterparts, holding all other predictors constant. Young males, on the other hand, tend to be working. The urban youth, on average, are more likely to be NEET or to advance to tertiary education than their rural counterparts. The rural youth, meanwhile, have a higher probability of being employed. Furthermore, being married increases the likelihood of being NEET and working and reduces the probability of being in education.

[5] The logits, which are the coefficients resulting from the multinomial logistic regression, are difficult to interpret. At best, they show relationships, but they do not provide the magnitude. Hence, the results are transformed into marginal effects.

[6] See Appendix One for the results of the odds ratios.

TABLE 4. Results from the multinomial logistic regression for 16-17 years of age
(Average marginal effects, weighted)

Variables	Outcomes (16-17 yrs old)			
	NEET	Employed	In Secondary	In Tertiary
Reform effect				
postreform1=0 (ref.)				
postreform1=1	-0.080***	-0.091***	0.433***	-0.262***
Sex				
male (ref.)				
female	0.020***	-0.098***	0.010**	0.068***
Location				
rural (ref.)				
urban	0.016***	-0.033***	-0.021***	0.039***
Highest level reached by Household Head				
no education (ref.)				
primary	-0.029**	-0.101***	0.069***	0.061***
secondary	-0.060***	-0.185***	0.082***	0.162***
tertiary	-0.125***	-0.221***	0.066***	0.280***
Civil Status				
single (ref.)				
married	0.302***	0.172***	-0.325***	-0.148***
Number of household members	0.004***	0.005***	0.006***	-0.015***
Observations	82,741	82,741	82,741	82,741

1. Level of significance: * $p<0.05$ ** $p<0.01$ *** $p<0.001$
2. Coefficients on the regional variables not shown here.

TABLE 5. Results from the multinomial regression model for 18-19 years of age
(Average marginal effects, weighted)

Variables	Outcomes (18-19 yrs old)			
	NEET	Employed	In Secondary	In Tertiary
Reform effect				
postreform2=0 (ref.)				
postreform2=1	-0.047***	-0.115***	0.190***	-0.028***
Sex				
male (ref.)				
female	0.079***	-0.164***	-0.029***	0.114***
Location				
rural (ref.)				
urban	0.013**	-0.030***	-0.008*	0.026***
Highest level reached by Household Head				
no education (ref.)				
primary	0.005	-0.113***	0.015	0.093***
secondary	-0.013	-0.222***	-0.002	0.236***
tertiary	-0.094***	-0.302***	-0.043***	0.438***
Civil Status				
single (ref.)				
married	0.253***	0.187***	-0.114***	-0.325***
Number of household members	0.006***	0.005***	0.005***	-0.016***
Observations	77,630	77,630	77,630	77,630

1. Level of significance: * $p<0.05$ ** $p<0.01$ *** $p<0.001$
2. Coefficients on the regional variables not shown here.

Interacting the sex and location dimensions (Tables 6 and 7), young women in rural areas tend to have the highest predicted probability of being NEET, more than their urban counterparts as well as male counterparts (young men in rural areas). Young men in rural areas have a higher probability of finding employment compared with their male counterparts. Reviewing studies about the gendered roles in Philippine rural communities, this is not surprising. Work in rural areas is a predominantly male sphere, especially as agricultural activities like land preparation, harvesting, and threshing activities require manual labor. Furthermore, rural communities assign traditional roles between girls and boys in terms of contribution to the household. Female children are expected to help their mothers in child-rearing and household management, while male children work with their fathers in fishing or farming (Pomeroy [1987]; Sakellariou and Lall [2000]).

Interacting civil status and sex (Tables 6 and 7), the probability of being NEET increases remarkably for young girls when they marry—70 percent for 16-17 years old and 75 percent for the 18-19 years old—much higher than their male counterparts and even unmarried young girls (20 percent or less). This may be partly due to traditional roles assigned to married women, such as childcare and housekeeping [Alcantara 1994]. However, this may not necessarily be a long-term situation, but a transitory status as the young woman tends to the child in his/her early years. Unfortunately, the dataset does not allow confirmation of this speculation, as it only records the decision or outcome at a specific point in time. A longitudinal analysis is more helpful in validating this, which requires different survey data. Nonetheless, recent studies show that gendered roles in marriage—where women only focus on household management and child-rearing—are eroding as more and more married women are joining the labor force, not just domestically but also internationally, and complementing household income by engaging in entrepreneurial activities (Alcantara [1994]; Gultiano and Xenos [2006]; McKay [2005]).

On the end of the spectrum, young females are significantly more likely than males to be in school, and more likely to advance to tertiary education at the age of 18–19 years. This supports earlier studies showing that Filipino females outperform boys in basic education, enabling them to advance to tertiary education, and thus the results of more females completing college degrees than males (DeGraff et al. [1996]; Paqueo and Orbeta [2019]). The results suggest that while females, on average, have a bigger probability to be NEET, especially when compounded by factors such as marriage and remaining in rural areas, the probability of completing education or even progressing to tertiary education is higher if given investments.

Parental education is also significantly related to youth outcomes. The increasing level of parental education is associated with a decreasing probability of the youth working, being NEET, and being delayed in schooling (i.e., in secondary education at age 18-19). Two interpretations can be derived from this finding. One, more educated parents exert less pressure on their young children to work, possibly because they are less constrained in terms of household resources. Two, the aspirations of the parents are being transmitted to their children. The

first point anchors on empirical evidence in the Philippines that has shown a clear link between youth labor and socioeconomic characteristics, such as household income and parental education (Aldaba et al. [2004]; Camacho [1999]; Sakellariou and Lall [2000]). These studies argue that schooling costs, perceived poor quality of education, and perceived low benefits of schooling are key considerations of parents in pulling their children out of education and making them work. Thus, resource constraints and poverty, often associated with the lack of education of household heads, become deterrents in choosing education. The second point is based on findings concerning the intergenerational transmission of aspirations. A qualitative study in the Philippines has found that youth aspirations in education and employment-related decisions are almost similar to their parents' [Torres 1982]. In particular, young people tend to drop out of school and seek employment if the father has only reached primary school. Meanwhile, a recent study in the Philippines, using a longitudinal and intergenerational survey dataset in a particular locality in the Philippines (Metropolitan Cebu), has found that mothers' educational aspirations, experiences, and educational attainment are strong predictors of the child's educational attainment [Gipson and Hindin 2015]. This provides evidence of the gains of educating the youth, especially girls, as the effects are transmitted intergenerationally.

Lastly, increasing household size is positively associated with being NEET, employed, and delays in schooling for those 18-19 years old (i.e., being in secondary instead of tertiary education). This is consistent with some findings in studies in the Philippines that look into relationships of family size and education-work decisions. Gipson and Hindin [2015] find in their longitudinal study that children whose household size is seven or greater have higher risks of not completing school in a given year.

Finally, the results show that on average, the period of reform is associated with a reduction in the probabilities of being NEET and being employed. From an education policy perspective, these associated changes represent improvements as more young people are in school. As expected, there is an associated decrease in the probability of being in tertiary education for the 16-17 years age group and an increase in the likelihood of being in secondary education due to the introduction of SHS.

It is interesting to find that for aged 18-19 years, the reform is associated with a reduction in the probability of being in tertiary education, although they should have already been at that level. This is indicative of widespread delays in schooling, but that the K-12 reform might have induced more young people to complete their secondary education due to the reform's promise. However, the associated reduction of the probability of being employed suggests two things: either young people after the reform are not easily absorbed by the labor market (labor demand issue), or they simply choose to not work and pursue further schooling (labor supply consideration). Moreover, with the introduction of the free tuition policy starting in 2017, there are added incentives to proceed to tertiary education. Therefore, there is reason to suspect that more young people will want to complete secondary schooling, even if they are delayed.

TABLE 6. Results from the multinomial regression model for 16-17 years of age
(Average predicted probabilities, weighted)

Variables	Outcomes (16-17 yrs old)			
	NEET	Employed	In Secondary	In Tertiary
Reform effect				
postreform1=0 (ref.)	0.174***	0.174***	0.315***	0.337***
postreform1=1	0.094***	0.083***	0.748***	0.075***
Sex				
male (ref.)	0.128***	0.187***	0.488***	0.197***
female	0.148***	0.089***	0.498***	0.265***
Location				
rural (ref.)	0.136***	0.151***	0.502***	0.211***
urban	0.152***	0.117***	0.481***	0.250***
Highest level reached by Household Head				
no education (ref.)	0.205***	0.291***	0.422***	0.083***
primary	0.175***	0.189***	0.491***	0.144***
secondary	0.144***	0.106***	0.504***	0.245***
tertiary	0.079***	0.070***	0.488***	0.363***
Civil Status				
single (ref.)	0.130***	0.135***	0.500***	0.234***
married	0.432***	0.307***	0.175***	0.086***
Reform effect * Sex				
Male				
postreform1=0 # male	0.153***	0.228***	0.332***	0.287***
postreform1=1 # male	0.090***	0.127***	0.716***	0.067***
Female				
postreform1=0 # female	0.187***	0.121***	0.300***	0.391***
postreform1=1 # female	0.090***	0.040***	0.787***	0.083***
Reform effect * Location				
Rural				
postreform1=0 # rural	0.167***	0.196***	0.326***	0.311***
postreform1=1 # rural	0.089***	0.084***	0.759***	0.067***
Urban				
postreform1=0 # urban	0.185***	0.141***	0.307***	0.366***
postreform1=1 # urban	0.101***	0.081***	0.736***	0.082***
Reform effect * HH head education				
no education				
postreform1=0 # no education	0.206***	0.325***	0.346***	0.123***
postreform1=1 # no education	0.202***	0.242***	0.532***	0.024**
primary				
postreform1=0 # primary	0.210***	0.234***	0.349***	0.208***
postreform1=1 # primary	0.124***	0.125***	0.701***	0.050***
secondary				
postreform1=0 # secondary	0.185***	0.139***	0.316***	0.360***
postreform1=1 # secondary	0.084***	0.058***	0.781***	0.077***
tertiary				
postreform1=0 # tertiary	0.099***	0.100***	0.267***	0.535***
postreform1=1 # tertiary	0.051***	0.027***	0.811***	0.111***
Location * Sex				
rural # male	0.114***	0.218***	0.495***	0.173***
rural # female	0.150***	0.085***	0.514***	0.251***
urban # male	0.148***	0.141***	0.488***	0.222***
urban # female	0.147***	0.096***	0.477***	0.280***
Civil Status * Sex				
single # male	0.127***	0.179***	0.495***	0.199***
single # female	0.134***	0.088***	0.508***	0.270***
married # male	0.168***	0.475***	0.232***	0.125***
married # female	0.708***	0.129***	0.116***	0.047***
Observations	82,741	82,741	82,741	82,741

Notes:
1. Level of significance: * $p<0.05$ ** $p<0.01$ *** $p<0.001$
2. Coefficients on the regional variables not shown here.

TABLE 7. Results from the multinomial regression model for 18-19 years of age
(Average predicted probabilities, weighted)

Variables	Outcomes (18-19 yrs old)			
	NEET	Employed	In Secondary	In Tertiary
Reform effect				
postreform1=0 (ref.)	0.233***	0.293***	0.103***	0.372***
postreform1=1	0.186***	0.177***	0.293***	0.344***
Sex				
male (ref.)	0.172***	0.358***	0.156***	0.313***
female	0.251***	0.194***	0.128***	0.428***
Location				
rural (ref.)	0.218***	0.282***	0.146***	0.354***
urban	0.231***	0.252***	0.138***	0.379***
Highest level reached by Household Head				
no education (ref.)	0.249***	0.463***	0.147***	0.141***
primary	0.255***	0.350***	0.162***	0.233***
secondary	0.236***	0.241***	0.145***	0.377***
tertiary	0.155***	0.161***	0.104***	0.579***
Civil Status				
single (ref.)	0.188***	0.264***	0.153***	0.395***
married	0.441***	0.451***	0.038***	0.070***
Reform effect * Sex				
Male				
postreform2=0 # male	0.178***	0.385***	0.118***	0.319***
postreform2=1 # male	0.146***	0.260***	0.304***	0.289***
Female				
postreform2=0 # female	0.264***	0.216***	0.087***	0.433***
postreform2=1 # female	0.201***	0.109***	0.283***	0.407***
Reform effect * Location				
Rural				
postreform2=0 # rural	0.226***	0.308***	0.110***	0.356***
postreform2=1 # rural	0.188***	0.186***	0.282***	0.344***
Urban				
postreform2=0 # urban	0.243***	0.274***	0.093***	0.389***
postreform2=1 # urban	0.184***	0.166***	0.306***	0.344***
Reform effect * HH head education				
no education				
postreform2=0 # no education	0.252***	0.495***	0.108***	0.145***
postreform2=1 # no education	0.240***	0.342***	0.296***	0.122***
primary				
postreform2=0 # primary	0.266***	0.381***	0.120***	0.233***
postreform2=1 # primary	0.210***	0.232***	0.323***	0.234***
secondary				
postreform2=0 # secondary	0.248***	0.263***	0.105***	0.384***
postreform2=1 # secondary	0.192***	0.159***	0.298***	0.351***
tertiary				
postreform2=0 # tertiary	0.160***	0.178***	0.069***	0.593***
postreform2=1 # tertiary	0.135***	0.097***	0.241***	0.527***
Location * Sex				
rural # male	0.148***	0.406***	0.161***	0.286***
rural # female	0.263***	0.175***	0.131***	0.431***
urban # male	0.201***	0.304***	0.153***	0.342***
urban # female	0.235***	0.220***	0.122***	0.423***
Civil Status * Sex				
single # male	0.175***	0.324***	0.167***	0.334***
single # female	0.204***	0.199***	0.138***	0.460***
married # male	0.151***	0.724***	0.048***	0.077***
married # female	0.744***	0.164***	0.028***	0.064***
Observations	77,630	77,630	77,630	77,630

Notes:
1. Level of significance: * $p<0.05$ ** $p<0.01$ *** $p<0.001$
2. Coefficients on the regional variables not shown here

5.2. Structural inequalities and changes following the reform

The results of the regression analysis suggest that differences in outcomes are characterized by structural inequalities. Across groups, the outcome of youth being in education is associated with characteristics such as high educational attainment of household head, being single, and low family size. However, it is important to look at the intersectionality of characteristics rather than looking at each predictor separately. This means rather than focusing on one dimension while holding all other variables fixed, combining multiple sources of disadvantages or advantages acknowledges the interplay of different dimensions of inequality (McBride et al. [2015]; Zuccotti and O'Reilly [2019]).

In this sub-section, hypothetical profiles are constructed based on different combinations of the independent variables to differentiate between advantaged and disadvantaged groups. This means the control variables of the specified logistic regression model are set to specific values, which are assumed to be characteristics associated with being advantaged or disadvantaged.[7] As such, the advantaged group has a fixed set of characteristics that differ from the disadvantaged group.

This study hypothesizes that a young person who is advantaged is in an urban area, where infrastructure and economic opportunities are more accessible; and if employed, wages are higher and more stable than rural work. She/he resides in a household of four,[8] which means that fewer resources are needed to sustain it. Lastly, the household head—presumably one who is the breadwinner and makes decisions for the family—is highly educated, which is a predictor of the household's resources, from material support to education support.

The disadvantaged young person is the opposite—in rural areas, in a household of ten, [9] and whose household head has not studied at all. These characteristics put the youth at a disadvantage because rural areas tend to have poorer infrastructure and therefore have lower accessibility. Incomes in rural areas are lower and most of the work opportunities are seasonal if not precarious. Additionally, as discussed in the previous sub-section, the evidence points to high fertility or increasing household size as negatively associated with schooling decisions. A big household places greater demands for household duties. Another possibility is the effect of large households on the motivation of the youth to study, due to lack of space, time, and resources.

The lack of education of the household head is associated with a myriad of challenges, such as lower and unstable incomes, lower assets, and less support for education-related endeavors. These are findings widely observed in the literature on intergenerational transmission of social, cultural, and economic capital (Gipson and Hindin [2015]; Juárez [2015]).

[7] Instead of the usual mean values when calculating average predicted probabilities, as presented in Tables 6 and 7 in the previous sub-section.

[8] Based on the overall distribution of household size, four members in the household correspond to the 25th percentile.

[9] Based on the overall distribution of household size, ten members in the household correspond to the 95th percentile.

Table 8 shows the distribution of the sub-sample given these assumed attributes of advantaged and disadvantaged groups. While this sub-sample represents only three precent of the total sample, the number of observations is still substantial (greater than 4,000) to draw analysis from. Furthermore, this supports the existence of such realities even if marginal. To provide a more nuanced analysis, outcomes of boys and girls are differentiated. Afterward, the estimated parameters of the logistic regression model are applied to compute the predicted probabilities of each group. These predicted probabilities show the likelihood of each group to be in a certain outcome (i.e., NEET, employed, in secondary or in tertiary education).

TABLE 8. Distribution of the sub-sample of hypothetical profiles

	Girls	Boys
16-17 y/o		
Pre-reform Sub-Sample	684	642
Distribution, %		
Advantaged	95.7	94.5
Disadvantaged	4.3	5.5
Post-reform Sub-Sample	362	411
Distribution, %		
Advantaged	96.3	96.7
Disadvantaged	3.7	3.4
18-19 y/o		
Pre-reform Sub-Sample	881	826
Distribution, %		
Advantaged	97.8	94.7
Disadvantaged	2.2	5.3
Post-reform Sub-Sample	185	165
Distribution, %		
Advantaged	95.7	96.2
Disadvantaged	4.3	3.8

"Advantaged": urban, household size = 4, and household head tertiary level educated
"Disadvantaged": rural, household size = 10, and the household head has no education
"Pre-reform": 2010-2015
"Post-reform": 2016-2019

Assuming these two polarized scenarios, the differences and the inequalities in the system are observed. This is even more perceptible when disaggregated by sex. Figures 6 and 7 show the predicted probabilities of disadvantaged and advantaged females and males in the two age groups, respectively. The predicted probabilities before and after the reform are compared to see whether the reform is associated with any changes in these groups. The results show that while there is a general increase in the likelihood of being in the more desirable outcomes (being in education), inequalities remain largely unchanged after the reform.

One, disadvantaged females have the highest predicted probabilities of being NEET. Considering how mothers' education plays a role in their children's education and future capabilities, this is troubling as it may contribute to the transmission of poverty and widening inequalities across generations. Even though there is a wide perception of the value of education and the seemingly high investment of families in females, the reality is that there are females left behind. These are usually girls in rural areas, have a large household to support, and likely to marry at an early age unless they migrate to urban areas.

Second, disadvantaged males still have the highest probabilities of being employed, although there have been associated reductions in the probabilities in both age groups. They also have the lowest probabilities of being in education (secondary and tertiary combined). This could be an indication of the prevalence of the gendered role of males, especially in rural areas. In particular, the study by Estudillo et al., [2001] on family investment strategy—wherein males inherit the land for working and females are sent to school—may explain this result. However, this leads to the phenomenon of boys being left behind in the Philippines.

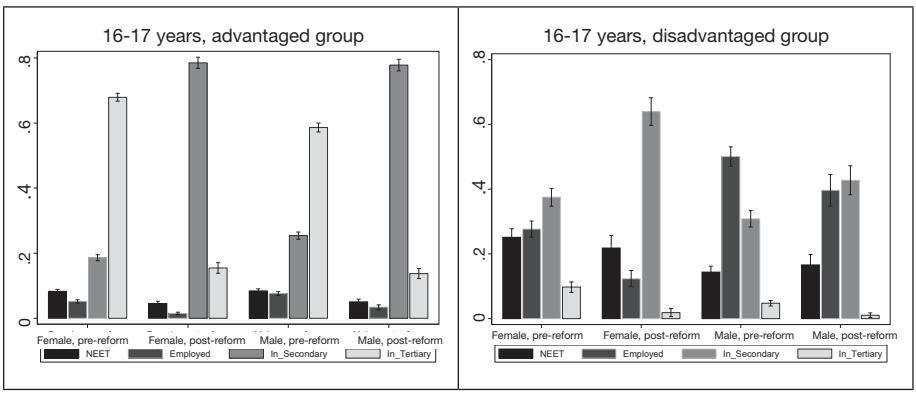
Third, both young men and women in advantageous positions are more likely to be in education. This is expected, considering that they have more resources, face fewer pressures of working or contributing to household production because the household is relatively small, and education institutions are accessible. What is surprising, however, is the existing probability of being NEET in these groups, albeit less than 20 percent—still lower than the probabilities in the disadvantaged group. This suggests that the availability of resources and accessibility may not necessarily prevent one from being NEET. Consequently, one can even speculate that because of these resources, they can afford to be NEET. This does not automatically mean that they aspire to be inactive. One may speculate that a young person who faces fewer pressures to go to school or find a job immediately can afford to wait for better opportunities if it pays off in the long run. In some cases, because of the safety net provided by the family, they may also take the time to be inactive, albeit not necessarily for a long period of time.

Lastly and quite worryingly, disadvantaged males have higher probabilities of being NEET after the reform. One possible reason is waning employment opportunities in rural areas, due to the declining productivity in the agriculture sector [Urich and Gultiano 2005]. Another reason—although highly speculative and needing verification on the ground—is the re-focusing of household spending priorities due to the increase in the cost of education. Recalling the rural household strategy of investment regarding their children, it is possible that given a large household and the additional two years in basic education that require resources, families may have instead focused on the girls. While the increase in the probability of being NEET of these disadvantaged males is marginal, this merits investigation and monitoring in the future, as it may lead to worsening inequalities. In the literature, male NEETs are the most susceptible to substance

abuse, delinquency, and mental illnesses (Bania et al. [2019]; Furlong [2006]; Gutiérrez-García et al. [2018]; Ling and O'Brien [2013]; Maguire [2015]). While evidence on the long-term effects of Filipinos being NEET remains a gap in the literature, research in other countries provide evidence of NEETs finding difficulties in getting back to education and being absorbed by the labor market, especially as they grow older and lack the necessary skills and experience [Gregg and Tominey 2005]. More than economic penalties, perceptions in the Filipino society associate being NEET or an 'istambay' with problematic behaviors such as drinking, gambling, and drug abuse [Batan 2012].

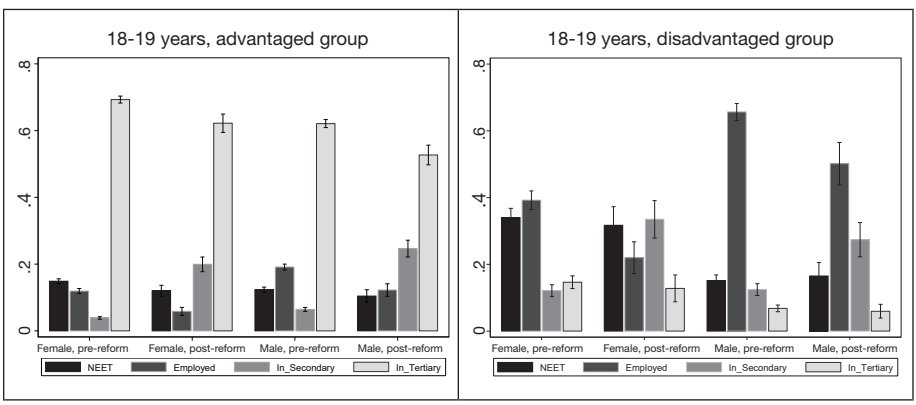
While one might argue the extremeness of these scenarios, these are realities present in society. These findings also highlight the fact that despite expanding access to education, outcomes will differ across groups, especially as advantages and disadvantages seem to compound each other.

FIGURE 6. Average predicted probabilities, scenarios for youths aged 16-17 years



Spikes indicate 95% confidence intervals. The bars represent the predicted probability (y-axis) of being NEET, employed, in Secondary level, or Tertiary level given the category (x-axis).

FIGURE 7. Average predicted probabilities, scenarios for youths aged 18-19 years



Spikes indicate 95% confidence intervals. The bars represent the predicted probability (y-axis) of being NEET, employed, in Secondary level, or Tertiary level given the category (x-axis).

6. Discussion and conclusion

This research has found that the last decade has seen an increasing share of the youths to be in education, accompanied by declining proportions of them in employment and NEET. There are certain characteristics associated with each outcome. Being in education is associated with characteristics such as being single, high educational attainment of household head, and low family size—conditions highly associated with affluence. Meanwhile, young women tend to be NEET more than their male counterparts, while young men are more likely to be working. The urban youth, on average, are more likely to be NEET or to advance to tertiary education than their rural counterparts. Interacting sex with the location and civil status variables, the findings point to girls in rural areas and married girls having the highest probability of being NEET (compared with all other groups, such as rural males, urban females, and urban males). This suggests that when traditional roles prevail, young women are likely to be NEET.

As for pervading inequalities, combining multiple sources of disadvantage or advantage reveal stark differences across groups. Those in the disadvantaged groups (larger households, in rural areas, uneducated household heads) tend to have higher probabilities of being NEET or working. The advantaged groups (smaller households, in urban areas, and college-educated household heads) have higher probabilities of being in education. Interestingly, NEETs are present even in advantaged groups, thus suggesting that being NEET is not necessarily due to resource constraints, but because they can also afford to be one. One reason, as drawn from sociocultural studies in the Philippines, is the availability of informal safety nets provided by the family or the community. The results also reveal that young women in the disadvantaged group (both age groups) tend to have the highest probability of being NEET. On the one hand, this could be due to prevailing traditional viewpoints on gender, especially in rural areas. On the other hand, it might be due to constraints stemming from the inaccessibility of schools or scant job opportunities in these areas.

As for the question seeking to investigate changes in outcomes following the reform, the results show an associated drop in the probabilities of being NEET and being employed, holding all else constant. As expected, there is an associated reduction in the probability of being in tertiary education for the 16-17 years age group, and a rise in the likelihood of being in secondary education due to the introduction of SHS. It is, however, interesting to find that the same results are observed for the older group (18-19 years old), although they should be in tertiary education—assuming that they entered the education system given the ideal age and have not dropped out nor repeated a grade in the course of their studies. This irregularity is suspected to be an indication of a lack of fidelity in compulsory schooling implementation. Still, the increase in probability suggests that the K-12 reform may have induced more young people to complete their secondary education due to the reform's promise. Moreover, the adoption of

another education reform—which expands access to tertiary education by making tuition-free in public tertiary education institutions and providing subsidies for those wanting to study in private tertiary education institutions—might have provided additional incentives to complete basic education.

Finally, while the results show an increase in the likelihood of the 'more desirable' outcomes (being in education), inequalities remain largely unchanged after the reform. First, disadvantaged females still have the highest predicted probabilities of being NEET. Second, disadvantaged males still tend to be working. Third, both males and females in advantageous positions are more likely to be in education. Lastly, disadvantaged males have a higher probability of being NEET after the reform. One possible reason is waning employment opportunities in rural areas, due to the declining productivity in the agriculture sector. Another possible reason is that, due to increasing costs of education, families may have prioritized the education of the girls among their members, which is suggested by previous studies. While the increase is marginal, this merits investigation and monitoring in the future, as it may lead to worsening inequalities. Even so, the period following the adoption of the reform is not associated with widened inequalities. However, given that disadvantaged groups tend to be in less desirable outcomes (i.e., not in education), this may have repercussions in their future, as hypothesized by the life course theory and evidenced by studies in other countries relating to wage and employment scarring. While this research is unable to validate this hypothesis, this leaves room for future research.

However, this research also has its limitations. One, due to data availability, static analysis has been conducted rather than a dynamic one. This means it was unable to trace the changes of outcomes of everyone in the survey, and thus, unable to understand whether these youth outcomes are transitory or long-term. This limitation in scope, however, provides space for future research. To determine the long-term effects of youth outcomes at this juncture, a longitudinal analysis needs to be conducted. For example, researchers may try to investigate whether being in 'less desirable' outcomes does penalize them in the future, especially when they are adults. Therefore, the government should invest in data collection that will allow researchers to conduct longitudinal studies and more in-depth mixed methods research to better understand the effects of the reform.

Acknowledgements: Marianne Joy A. Vital is an independent research consultant. This research is conducted for the author's MPhil dissertation at the University of Cambridge in the United Kingdom. The author received invaluable support from Dr. Rob Gruijters (research supervisor). The comments of the two anonymous reviewers of the Philippine Review of Economics are acknowledged. All errors are solely those of the author.

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Appendix

TABLE A.1 Results from the multinomial regression model for 16-17 years of age
(odds ratios, weighted; reference category = "In Secondary Education")

Variables	Outcomes (16-17 yrs old)		
	NEET	Employed	In Tertiary
Reform effect			
postreform1=0 (ref.)			
postreform1=1	5.238***	3.561***	6.295***
Sex			
male (ref.)			
female	0.809***	0.270***	0.590***
Location			
rural (ref.)			
urban	0.968	0.421***	0.738***
Highest level reached by Household Head			
no education (ref.)			
primary	0.590***	0.404***	0.579***
secondary	0.290***	0.130***	0.291***
tertiary	0.0961***	0.0585***	0.160***
Civil Status			
single (ref.)			
married	2.300***	5.131***	0.689
Household Size	1.123***	1.137***	1.105***
Reform effect * Sex			
Post-reform and Female == 1	0.848*	0.649***	1.421***
Reform effect * Location			
Post-reform and Urban == 1	1.038	1.509***	1.048
Reform effect * HH head education			
no education (ref.)			
primary	0.475*	0.577	1.099
secondary	0.400*	0.514	1.570
tertiary	0.473	0.356**	2.062*
Location * Sex			
Urban and Female == 1	0.883*	2.197***	1.061
Civil Status * Sex			
Married and Female == 1	15.66***	2.074**	1.444
Observations	82,741	82,741	82,741

Notes:
1. Level of significance: * p<0.05 ** p<0.01 *** p<0.001
2. Coefficients on the regional variables not shown here.

TABLE A.2 Results from the multinomial regression model for 18-19 years of age
(odds ratios, weighted; reference category = "In Tertiary Education")

Variables	Outcomes (18-19 yrs old)		
	NEET	Employed	In Secondary
Reform effect			
postreform2=0 (ref.)			
postreform2=1	1.237	0.849	2.552***
Sex			
male (ref.)			
female	0.886**	0.297***	0.452***
Location			
rural (ref.)			

TABLE A.2 Results from the multinomial regression model for 18-19 years of age (continued)

(odds ratios, weighted; reference category = "In Tertiary Education")

Variables	Outcomes (18-19 yrs old)		
	NEET	Employed	In Secondary
urban	1.083*	0.563***	0.680***
Highest level reached by Household Head			
no education (ref.)			
primary	0.652***	0.463***	0.679***
secondary	0.354***	0.183***	0.349***
tertiary	0.130***	0.0742***	0.141***
Civil Status			
single (ref.)			
married	4.409***	12.48***	1.401
Household Size	1.090***	1.080***	1.095***
Reform effect * Sex			
Post-reform and Female == 1	0.829*	0.748***	1.263***
Reform effect * Location			
Post-reform and Urban == 1	0.990	1.166	1.451***
Reform effect * HH head education			
no education (ref.)			
primary	0.657	0.714	0.819
secondary	0.703	0.779	0.960
tertiary	0.791	0.712	1.235
Location * Sex			
Urban and Female == 1	0.833***	2.234***	1.196**
Civil Status * Sex			
Married and Female == 1	7.421***	0.599***	1.103
Observations	77,630	77,630	77,630

Notes:
1. Level of significance: * $p<0.05$ ** $p<0.01$ *** $p<0.001$
2. Coefficients on the regional variables not shown here