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Income inequality, weak institutions, and the emergence of reform-abortive corruption

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We propose a statutory/norm approach for understanding the emergence of rent-seeking corruption using a 2×2 collective action game. In the status quo, self-interested players converge on a market-failure equilibrium, which is inferior to the cooperative outcome. The government attempts to shift behavior toward cooperation by enacting statutes that prohibit defection through penalties and enforcement mechanisms. The effectiveness of these interventions depends on sufficiently high expected penalties and low implementation costs, which are conditions characteristic of upright governance. When government is weak, however—particularly when it is vulnerable to bribes—statutes are undermined. Income inequality magnifies this vulnerability: elites benefit from the status quo and possess resources to finance bribes that dilute, reshape, or block reforms, while the poorer majority faces prohibitive monetary and electoral lobbying costs. This dynamic produces an Olsonian "tyranny of the minority," in which a small but affluent group prevails over the numerically larger majority. As a result, the combination of weak institutions and high inequality impedes reforms that would otherwise enhance utilitarian welfare. Our analysis underscores how governance quality and income distribution jointly shape the effectiveness of statutory interventions, offering insight into why national reform initiatives often fail in contexts characterized by weak rule of law.

JEL classification: C72, D72
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1. Introduction

Collective action problems arise when members of society are expected to contribute to the creation of social assets that generate broad, non-excludable benefits. However, some individuals may choose to free ride, refraining from contributing while still enjoying the resulting public good (e.g., a bridge or a water-impounding structure such as a dam). Collective action initiatives can succeed, as in the case of the Three Gorges Dam in China, or fail, as illustrated by the stalled Kaliwa River Dam project in the Philippines (Chavez [2024]; Flores [2025]). In such settings, free riders gain by accessing the public good without bearing its cost, while contributors are left worse off, having shouldered the burden that others avoided.

The Government is arguably the most important human institution for addressing collective action problems in large polities (Hobbes 1996[1651]; Rousseau 1941[1762]; Smith 1937[1776]; Nozick [1973]). Samuelson [1955] demonstrated that when public goods rely on private voluntary contributions from a large number of self-interested individuals, the result is a market failure, specifically, the under-provision of public goods. Private agents contribute only up to the value of their own utility from the good, disregarding the benefits received by others. A Benevolent Central Planner, fully informed of individual utilities, could in principle correct this failure by levying taxes proportional to the utility each member derives from the public good and providing the efficient level of the good. Mancur Olson [1965] advanced this argument by asserting that in large polities composed of self-interested individuals, voluntary private provision may lead not merely to under-provision but to zero provision of public goods. Because individuals can consume the public good regardless of their contribution, each has an incentive to free ride, resulting in complete non-provision failure (the *zero public goods provision hypothesis*). In both cases, the outcome is a *public goods* failure rooted in the collective action problem.

Governments communicate their intentions to their constituents through the promulgation of statutes and norms, which articulate how political authorities aim to advance social welfare by addressing collective action problems. These statutes specify which actions are prohibited or encouraged, determine the contributions required for public goods provision, and set the penalties for violations. This statutory approach reflects the long-standing view in political philosophy and economics that effective collective action in large polities requires the intervention of a third party—the Government. From Samuelson's [1954; 1955] and Olson's [1965] frameworks, the government acts as a "Benevolent Central Planner" whose authority and monopoly on the legitimate use of force enable it to curb free riding and ensure adequate public goods provision. This perspective aligns with Hobbes's Leviathan, which imposes order in a state of nature marked by "a *warre* of all against all," though at the cost of extensive individual subordination. Other traditions, such as Locke's [2013] democratic social contract or Condorcet's Jury

Theorem, emphasize that the legitimacy of governing authority may stem from consent and collective decision-making rather than coercion.

Yet regardless of whether the sovereign's power to govern emerges through democratic delegation, social contract, or other institutional arrangements, its intent must ultimately be expressed through programs and statutes that shape citizens' behavior and expectations. Under this logic, the system of statutes, norms, and enforcement mechanisms constitutes what Acemoglu, and Robinson [2012] describe as "rule of law," which is central to explaining whether nations succeed or fail. A robust rule of law, characterized by the protection of property rights and the enforcement of contracts, creates the institutional environment necessary for wealth generation. It also determines how economic surplus is allocated according to what the polity considers fair, whether distributed broadly in democratic societies or concentrated among a privileged few, such as oligarchic elites.

In this paper, we trace the emergence of rent-seeking corruption to weak institutions that have been captured by a privileged minority—oligarchs—who, empowered by income inequality, are able to influence the formulation and implementation of statutes and norms intended to align individual behavior with the common good in collective action settings. We decompose the process of statute formation into its constituent stages and demonstrate how, at each step, rent-seeking opportunities arise as a direct consequence of institutional weakness.

2. Dam Construction Game (*DCG*) as collective action problem

Two self-interested and myopic agents, *A* and *B*, are confronted with the public goods problem of providing a dam for irrigation and flood control. Completing the dam project requires the cooperation of both parties; unilateral effort by only one party is insufficient. If both parties cooperate, the project succeeds (the dam is built), and both agents—as well as the wider community—benefit. Each agent's strategy set is (*C*, *D*), where *C* denotes "Cooperate" and *D* denotes "Don't Cooperate." The resulting 2×2 full *DCG* in normal form is shown in Table 1.

TABLE 1. Payoff matrix of a 2x2 *DCG*

		B	
		C	***D***
A	***C***	A_{CC}, B_{CC}	A_{CD}, B_{CD}
	D	A_{DC}, B_{DC}	A_{DD}, B_{DD}

We assume the following conditions for *DCG*: (1) $A_{CC} > A_{DD}$ and $B_{CC} > B_{DD}$; (2) $A_{DD} > A_{CD}$ and $B_{DD} > B_{DC}$; and (3) $A_{CC} < A_{DC}$ and $B_{CC} < B_{CD}$. Note that (*C*, *C*) strictly Pareto-dominates (*D*, *D*), i.e., A_{CC}, $B_{CC} > A_{DD}$, B_{DD}. These conditions make *DCG* a social dilemma game with a unique attractor at

(*D*, *D*), which is also the unique Nash equilibrium (NE). At (*D*, *D*), no player can improve his payoff by a unilateral deviation. Once the game is at (*D*, *D*), there is no incentive for either party to change strategies if the other remains at *D*. For example, if at (*D*, *D*) player *A* switches to *C*, *A* receives $A_{CD} < A_{DD}$, resulting in a lower payoff; the same logic applies symmetrically to player *B*.

The action profile (*C*, *C*) is not a Nash equilibrium of *DCG* by Condition (3); that is, if the players were to start at (*C*, *C*), each would have an incentive to deviate to *D*. This is mandated by the free riding problem in all dilemma games. Condition (1), however, indicates that (*C*, *C*) Pareto-dominates (*D*, *D*): both *A* and *B* are strictly better off at (*C*, *C*) than at (*D*, *D*). By assumption, successful completion of the dam requires mutual cooperation—only when both agents choose *C* does the project materialize.

DCG constitutes a collective action problem because the socially superior outcome cannot be achieved unless both parties cooperate. Under *laissez-faire* conditions—where no external authority intervenes—the dam will not be built, periodic flooding will continue, and irrigation will not materialize. The structure of *DCG* readily generalizes to settings with more than two participants while preserving the same essential features, a dynamic interaction commonly referred to as the "tragedy of the commons."

3. Enter a benevolent central planner

We now depart from the standard *laissez-faire* framework in elementary game theory by introducing a third party external to *A* and *B*—the government, *G*. Agents *A* and *B* belong to a community under *G*'s jurisdiction. For ease of exposition, let *G* be initially benevolent. Its central mission is to enable communities within its domain to achieve the highest feasible level of welfare, given available resources and technology—that is, to steer outcomes toward the cooperative profile (*C*, *C*), yielding payoffs (A_{CC} , B_{CC}) in Table 1. However, under *laissez-faire* conditions, the free riding imperative does not allow cooperation. Instead, it gravitates toward the disorderly non-cooperative equilibrium (*D*, *D*).

To achieve (*C*, *C*), *G* must redirect behavior away from its natural alignment toward (*D*, *D*) and instead guide it toward the cooperative outcome. To this end, the government promulgates a statute *S* designed to align individual incentives with cooperation. If *S* is effective, agents will be induced to choose *C*, and the cooperative outcome (*C*, *C*) will be attained.

3.1. Statutes as an alignment mechanism

A statute *S* has several key features. First, it identifies the punishable action, which in this case is defection *D*. Second, it specifies the enforcement regime, including a mandated contribution $c \geq 0$ from each party to support the program. Third, this contribution finances the enforcement mechanism that generates a probability f, with $0 \leq f \leq 1$, that a violator is detected and punished. Fourth, the statute defines the statutory penalty $p \geq 0$ imposed on an individual who is caught violating the statute. Revenue collected from defectors is added to the enforcement budget. With D understood as the deviant action, we represent the statute as $S = (c, p, f)$. Note that $c = 0$ corresponds to full financing of the dam by the national treasury, whereas $c > 0$ corresponds to local co-financing through community contributions. The statute S alters the incentives in the original game *DCG*, yielding a modified game *DCG′* with the payoffs shown in Table 2.

TABLE 2. The payoff matrix of *DCG′* (*DCG* modified by *S* = (*c*, *p*, *f*))

		B	
		C	***D***
A	***C***	$A_{CC} - c, B_{CC} - c$	$A_{CD} - c, B_{CD} - c - pf$
	D	$A_{DC} - c - pf, B_{DC} - c$	$A_{DD} - c - pf, B_{DD} - c - pf$

The contribution c must be paid by each player regardless of the game's outcome, whereas the expected penalty pf is imposed only on the player who chooses the defection strategy D.

3.2. Weak institutions

We now present a numerical example of a dam construction game in which, under *laissez-faire* conditions (i.e., without government intervention), the interaction leads to the attractor (D, D), representing a market failure. Suppose the *DCG* is characterized by the following payoff table:

TABLE 3. Payoff matrix of the Dam Construction Game (*DCG*): *Laissez Faire* Case

		B	
		C	***D***
A	***C***	(10, 10)	(2, 15)
	D	(15, 2)	(3, 3)

The unique attractor state of this game—equivalently, its unique Nash equilibrium—is (D, D), yielding payoffs of (3, 3). The socially optimal payoff profile is (10, 10), corresponding to (C, C), and clearly (10, 10) > (3, 3). However, (C, C) is not an attractor because it is vulnerable to free riding; left to themselves, the players will not voluntarily settle at (C, C). The social interaction, therefore, results in a social failure: agents pursuing their myopic self-interest converge to the inferior outcome (D, D). Without an external enforcing authority, A and B remain trapped in this suboptimal state where the dam is not built.

Now consider the introduction of a third party (i.e., the government) that promulgates a statute $S^* = (c = 2, p = 7, f = 1)$. Here, $c = 2$ is the tax (or contribution) levied on each player, p=7 is the statutory penalty for violation, and $f = 1$ indicates full certainty of detection and punishment. With a 100 percent apprehension rate, the government acts as a strong enforcer of the statute. The statute S^* modifies the original *DCG*, yielding a new game, *DCG′*, with payoffs shown in Table 4.

TABLE 4. The payoff matrix of *DCG′* with Statute *S = (2, 7, 1)**

		B	
		C	***D***
A	***C***	10 – 2, 10 – 2 = (8, 8)	2 – 2, 15 – 2 – 7 = (0, 6)
	D	15 – 2 – 7, 2 – 2 = (6, 0)	3 – 2 – 7, 3 –2 - 7 = (-6, -6)

To assess the welfare effects of the intervention, we compare the attractor state (Nash equilibrium) of the original game *DCG* with that of the modified game *DCG′* after the statute S^* is introduced. The transformed game *DCG′* has a unique attractor at (*C*, *C*), yielding payoffs of (8, 8), which is strictly greater than the (3, 3) payoff profile of the original attractor (*D*, *D*) in *DCG*. The statute S^* = (2, 7, 1) therefore produces a clear welfare improvement—whether assessed through Pareto dominance (since 8 > 3) or utilitarian aggregation (8 + 8 = 16 > 6 = 3 + 3). In this numerical example, statute S^* represents a *government or Visible Hand success*, achieving higher individual and collective welfare by steering behavior toward the cooperative outcome. In our terminology, the statute has resulted in overcoming the free riding problem.

3.3. Government failures

Promulgating a statute is one thing; formulating one that actually improves welfare is another. Under Samuelson’s [1954] idealized “benevolent central planner,” government intervention is guaranteed to succeed. In reality, however, governance is carried out by fallible human agents operating within imperfect institutions. In such settings, interventions may fail to achieve their intended goals and can even result in welfare losses.

Suppose *G* is weak and is able to promulgate only $S' = (c = 4, p = 4, f = 1/8)$, a much weaker alternative to S^* = (2, 7, 1). This weakness is reflected in a higher mandated contribution $c = 4 > 2$ for agents—perhaps due to wastage or corruption—a lower statutory penalty $p = 4 < 7$ for non-cooperation, and a greatly reduced probability of punishment $f = (1/8) < 1$. The payoff matrix of the game modified by S', denoted *DCG″*, is shown in Table 5.

TABLE 5. The payoff matrix of *DCG″*, with *S′* = (4, 4, (1/8))

		B	
		C	***D***
A	***C***	(10 – 4, 10 – 4) = (6, 6)	(2 – 4), (15 – 4 – 0.5) = (-2, 10.5)
	D	(15 – 4 – 0.5, 2 – 4) = (10.5, -2)	(3 – 4 – 0.5, 3 – 4 – 0.5) = (-1.5, -1.5)

The attractor state of *DCG″* remains (*D*, *D*), exactly as in the *laissez-faire* case. The players' behavior continues to be "defection" despite the presence of a statute. Worse still, the welfare outcome under *S′* at the attractor (*D*, *D*) is (-1.5, -1.5), which is inferior to the *laissez-faire* payoff of (3, 3). In this case, government intervention leaves society worse off. When *G* is weak, its statute can thus produce a clear government failure.

4. Inequality in the status quo state

Inequality may already be present in the initial condition, represented by the initial attractor (*D*, *D*). We introduce the following definitions:

Definition 1: Consider two *DCG*-games DCG^1 and DCG^2. A state $X = (X_A, X_B)$ where $X_i \in \{C, D\}$, $i = A, B$ in DCG^1 is **Pareto-superior** to a state $Y = (Y_A, Y_B)$ where $Y_i \in \{C, D\}$, $i = A, B$ in DCG^2 when every member of society is better off in *X* than in *Y* (i.e., $A_{X_A X_B} > A_{Y_A Y_B}$ and $B_{X_A X_B} > B_{Y_A Y_B}$).

Definition 2: Consider two *DCG*-games DCG^1 and DCG^2. A state $X = (X_1, X_2)$ where $X_i \in \{C, D\}$, $i = A, B$ in DCG^1 is **utilitarian-superior** to a state $Y = (X_1, X_2)$ where $Y_i \in \{C, D\}$, $i = A, B$ in DCG^2 when the sum of all individuals' utilities in *X* exceeds the sum of their utilities in *Y* (i.e., $A_{X_1 X_2} + B_{X_1 X_2} > A_{Y_1 Y_2} + B_{Y_1 Y_2}$).

Definition 3: Institutions are **strong** when the bribe required to induce the government *G* to deviate from its original design approaches infinity (∞).

Definition 4: Institutions are **weak** when the bribe needed to induce the government *G* to change course from its original design is much smaller than the net payoff received by either agent.

Suppose the modified *DCG* (called DCG^*) has the following payoff matrix:

TABLE 6. Payoff matrix of the modified Dam Construction Game (*DCG): *Laissez Faire* case**

		B	
		C	***D***
A	***C***	(10, 10)	(2, 15)
	D	(15, 2)	(3, 12)

Note that DCG^* differs from the original *DCG* in that the payoff at (*D*, *D*) is now (3, 12), rather than (3, 3) as in Table 3. The status quo is therefore payoff-unequal: if both defect, player *B* receives "12" in DCG^*, compared with "3" in the original *DCG*. In this modified setting, the initial attractor (*D*, *D*) in DCG^* disproportionately favors *B* (12 vs. 3), whereas the target attractor (*C*, *C*) continues to yield (10, 10), the same cooperative payoff profile as in Table 3.

Despite these changes, DCG^* remains a collective action failure under *laissez-faire*, with (*D*, *D*) as its unique attractor. It is also worth noting that the cooperative state (*C*, *C*) in DCG^* (Table 6) is **utilitarian-superior** to (*D*, *D*) in the original *DCG* (Table 3), since 10 + 10 = 20 > 3 + 3 = 6. However, it is **not Pareto-superior** to (*D*, *D*) in DCG^*, because player *B* receives "12" at (*D*, *D*) in DCG^* but only "10" at (*C*, *C*) in the original *DCG* given in Table 3.

With perfect information, both *A* and *B* recognize this payoff inequality, and *B* may, therefore, be tempted to sabotage any reform initiative that alters payoffs by shifting away from (*D*, *D*) in DCG^* to a state (*C*, *C*) in a revised *DCG* with a reform-oriented government statute. For instance, let the state promulgate and implement statute $S^* = (2, 7, 1)$ to the game DCG^*. This resulting modified game, which we denote DCG^{**}, has the payoff matrix given in Table 7.

TABLE 7. Payoff matrix of the new Dam Construction Game *DCG* which is the game *DCG** after implementing statute *S** = (2, 7, 1)**

		B	
		C	***D***
A	***C***	(10 – 2, 10 – 2) = (8, 8)	(2 – 2, 15 – 2 – 7) = (0, 6)
	D	(15 – 2 – 7, 2 – 2) = (6, 0)	(3 – 2 – 7, 12 –2 – 7) = (-6, 3)

Notice that with the statute S^*, the target state (*C*, *C*) in the game DCG^{**} becomes the attractor, and the dam is successfully built, yielding the payoff (8, 8). This state is **utilitarian-superior** to the status quo attractor (*D*, *D*) in DCG^* given in Table 6, which yields (3, 12), since 8 + 8 = 16 > 3 + 12 = 15. In this setting, the statute $S^* = (2, 7, 1)$ still constitutes a *Visible Hand success*: it displaces the original attractor (*D*, *D*) in DCG^* and replaces it with the cooperative attractor (*C*, *C*) in DCG^{**}.

However, the state (*C*, *C*) in DCG^{**} is **not Pareto-superior** to the status quo (*D*, *D*) in DCG^{*} because agent *B* receives a lower payoff at (*C*, *C*) in DCG^{**}. In the new attractor (*C*, *C*) in DCG^{**}, *B* obtains only "8" units, whereas he receives "12" units under the unequal status quo (*D*, *D*) in DCG^{*} when the reform is aborted. Thus, *B* is strictly better off if the reform fails and, therefore, has an incentive to bribe the authorities to block the transition to (*C*, *C*) in DCG^{**}.

How much can *B* afford to offer as a bribe? *B* is willing to pay up to "3" units to the authorities to block the reform, because doing so leaves him with 12 - 3 = 9 units—still higher than the "8" units he would receive if the dam were built under DCG^{**}. Table 8 presents the payoff matrix of a new game, denoted DCG^{Bribe}, which mirrors DCG^{*} but incorporates *B*'s 3-unit bribe to the government to secure the state (*D*, *D*). This is *B*'s preferred outcome—bribing to sabotage the reform—rather than supporting a transition to the cooperative state (*C*, *C*) in DCG^{**}.

TABLE 8. Payoff matrix of the Dam Construction Game (DCG^{Bribe}) with illicit side payment of "3" to *G*: The Aborted Reform Case

		B	
		C	***D***
A	***C***	(10, 10)	(2, 15)
	D	(15, 2)	(3, 9)

If institutions are **weak**, the government may indeed accept *B*'s 3-unit bribe and abort the reform. *B* then realizes a net payoff of 9 units after the bribe. Note that (*D*, *D*) remains the unique attractor of the game DCG^{Bribe} even after the 3-unit rent-seeking transfer.

If institutions are **strong**—that is, if the bribe required to induce the government to change course is effectively infinite—then the wealthier agent *B* cannot afford to offer a bribe large enough to make the authorities deviate from the original design without incurring a net loss. Under such conditions, rent-seeking corruption does not arise, and the reform effort proceeds as intended, shifting the interaction to the cooperative game DCG^{**}.

4.1. Players as coherent social classes

The analysis can also be extended to cases where players *A* and *B* represent relatively *coherent* social classes rather than individuals. *Coherence* here refers to the class's ability to share burdens and coordinate collective efforts effectively. This coherence is relative: each class is subject to what Olson [1965] describes as the "tyranny of the minority," whereby smaller, wealthier groups are more capable of collective action than larger, poorer ones. In this interpretation, *B* represents the Elite class—the fewer, favored group in the status quo attractor (*D*, *D*) in the *DCG* described in Table 3—while A represents the Non-Elite class, the larger and poorer segment of society. By the logic of Olson's [1965] tyranny, the Elite class is more internally coherent than the Non-Elite class, whose size and resource constraints make coordination more difficult.

As in the case of the game DCG^{Bribe}, this internal coherence allows the Elite class (B) to preserve its privileged position by sabotaging reforms that would have raised utilitarian welfare for the entire community—composed of both Elite and Non-Elite members, but utilitarian rather than Pareto-optimal. Through rent seeking, the Elite class successfully blocks reforms that would have generated broad welfare gains, thereby maintaining an unequal and inefficient status quo.

4.2. Possibility of a non-elite counter-lobby

Can the Non-Elite offer a counter-bribe to induce the authorities to complete the reform? Yes and no. While weak institutions may be indifferent to the source of illicit payments, they are not indifferent to the amount. The Non-Elite class (A) could, in principle, offer a counter-bribe—say, "4" units—drawn from the "8" units it expects to receive if the reform is successfully implemented in DCG^{**} (Table 7).

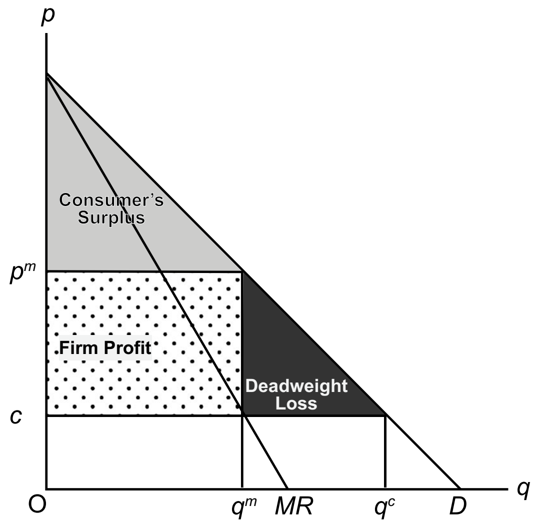
The Non-Elite faces what may be called a *numerical asymmetry problem* in any bribery contest. Under Olson's "tyranny of the minority," the capacity of the Non-Elite—the numerically large but poorer group—to raise a counter-bribe is severely constrained by its difficulty in coordinating contributions from many low-income members. The question, then, is whether weak authorities would accept the Non-Elite's nominal offer of "4" units over the Elite's smaller offer of "3" units and thus proceed with the reform [Olson 1965].

In practice, the authorities recognize the organizational disadvantages faced by the Non-Elite. Because the Non-Elite is far more numerous and far poorer, collecting contributions is cumbersome, uncertain, and slow. Anticipating these difficulties, authorities heavily discount the Non-Elite's promised payment. The effective value of the Non-Elite's offer becomes $4x$, where $x < 1$ represents the discount factor applied to the group's ability to deliver. Thus, the authorities will prefer the Elite's offer of "3" whenever $3 > 4x$, or equivalently whenever $x < 3/4$. Given the typical coordination disadvantages of large, poor groups, this condition is likely to hold. This numerical asymmetry problem is not unique to bribery scenarios; it is a general feature of collective action. Larger, less cohesive groups systematically struggle to mobilize resources compared to smaller, wealthier, and more coordinated elites.

4.3. Tyranny of the minority and the asymmetry in credible commitment: The case of a market monopoly

To illustrate a market failure arising from asymmetry under Olson's [1965] tyranny of the minority—where larger groups face higher coordination costs—consider a power distribution company that enjoys a monopoly position. The monopoly equilibrium (abstracting from regulatory complications) is shown in Figure 1. The monopolist produces at q^m and charges the price p^m. The area under the demand curve is partitioned into three components: the light gray region representing consumer surplus, the dotted region representing producer surplus (monopoly profit), and the dark gray region representing deadweight loss, which is entirely dissipated—no group in society captures it.

FIGURE 1. Monopoly and welfare shares of different groups



Note: Light gray area = consumer's surplus; Dotted area = producer's surplus; Dark gray area = deadweight loss (economic waste)
Source: Fabella et al. [2020].

Now suppose there exists a power consumer advocacy group (AG) committed to protecting consumers from potential abuses of monopoly power by the distribution utility (DU). Imagine that AG proposes the following contract to the DU: the utility agrees to produce at the competitive output q^c and sell electricity at the lower competitive price c. Under this arrangement, the entire area under the demand curve—the light gray, dotted, and dark gray regions—becomes consumer surplus. AG, in turn, commits to collect from consumers an amount equivalent to the "dotted area + half of the dark gray area" and transfer this as compensation to the DU. If such a contract were successfully implemented, both the DU and consumers would benefit. The DU receives compensation equivalent to its forgone monopoly profit plus half of the eliminated deadweight loss. Consumers enjoy lower electricity prices ($c < p^m$) and gain the light gray area plus the remaining half of the dark gray area. Society as a whole also benefits, as the deadweight loss disappears entirely. Remarkably, this cooperative outcome achieves efficiency without requiring government intervention.

Will the DU accept the offer? It will not, because AG cannot credibly commit to delivering its side of the contract. That commitment ultimately depends on AG's ability to overcome the collective action problem it faces. Power consumers would be expected to contribute voluntarily, but any individual consumer may choose to free ride or renege on the agreement. Collecting contributions from millions of relatively poor consumers entails extremely high transaction costs, making the promised payment effectively unenforceable. Given this, the DU cannot reasonably expect to receive the compensation AG pledges. Anticipating non-payment, the DU's equity holders would rationally vote to reject the proposed contract.

4.4. Weak legislature

Now, suppose the legislature enters the picture and threatens to revoke the DU's franchise through legislation. If the legislature is a weak institution—vulnerable to bribery—then the DU's equity holders, being few in number and relatively affluent, can mount a lobbying effort by offering legislators a bribe. The AG, by contrast, will be unable to match this offer. As before, legislators will heavily discount any pledge from AG because its contributors are extremely numerous and far poorer, making the collection of funds uncertain and costly. Consequently, the AG's initiative will again fall short, for the same reason that raising a counter-bribe from a large, dispersed group is prohibitively difficult.

Unless new technologies emerge that substantially reduce the cost of collecting contributions, many potential Coasean bargains will remain unrealized. This helps explain why, in the post–World War II era, numerous thinkers advocated the nationalization and state ownership of the "commanding heights of the economy," including the power and banking sectors [Yergin and Stanislaw 1998]. This view continues to hold sway in many countries, where state ownership of the power sector persists. However, weak institutions eventually undermined the effectiveness of the state-ownership model as well [Yergin and Stanislaw 1998], contributing to the shift toward market-oriented reforms associated with the first wave of the Washington Consensus in the 1980s.

If the government and its agencies function as strong institutions, they will reject any bribe offers, allowing welfare-enhancing interventions to proceed. Over time, this institutional strength manifests in markedly superior performance outcomes [Cook and Fabella 2002]. The contrast is evident, for instance, between the long-run trajectories of the Philippines and those of countries such as Vietnam.

In general, pervasive rent-seeking behavior renders the regulatory environment fragile, prompting investors to withdraw from the jurisdiction. More broadly, when weak institutions and rent seeking dominate, initial income inequality becomes a powerful barrier to reform. The greater the inequality, the stronger the vested interests that can block welfare-enhancing change—and the higher the likelihood that the nation will ultimately fail.

5. Conclusion

Collective action problems (CAPs) are social interactions in which outcomes depend jointly on the actions chosen by all players. In a 2×2 CAP, there are four possible states: (*C*, *C*), where both players cooperate; (*C*, *D*), where the row player cooperates while the column player defects; (*D*, *C*), the reverse; and (*D*, *D*), where both defect. Under the rational-choice paradigm, where agents are *homo economicus* who pursue only their individual payoffs, a CAP typically settles at the inferior state (*D*, *D*). This state yields payoffs for each player that are lower than those attainable at the cooperative state (*C*, *C*), but (*C*, *C*) is blocked by the free-riding incentive. The state (*D*, *D*) is a social failure in the sense that it provides each player with a payoff that is strictly inferior to the payoff they would receive at another feasible state—namely, (*C*, *C*). A social failure thus reflects the inability to achieve the cooperative outcome. The purpose of game transformations in CAPs is to replace the failed attractor (*D*, *D*) with the cooperative attractor (*C*, *C*). Initially, every CAP has (*D*, *D*) as its attractor—an inferior outcome for all players.

Our metric of analysis is monetary. We begin by defining a failed social state as one characterized by the action profile (*D*, *D*). A statute specifies which actions are prohibited (e.g., the use of dynamite in fishing) and sets the penalties for violations. As shown earlier, such an intervention transforms the nature of the game by altering its payoffs. A successful intervention reshapes the game so that the free riding problem is overcome, i.e., its Nash equilibrium becomes the desired cooperative state (*C*, *C*). This is the enforcement dimension of the statute, determined by the enforcement probability f and the statutory penalty p, with the product pf constituting the effective (or expected) penalty. When pf is low, behavioral change is insufficient, and the cooperative state (*C*, *C*) will not be attained. Government intervention succeeds only when the enacted rule is strong in both enforcement and penalty. A sufficiently high pf ensures that (*C*, *C*) becomes the new Nash equilibrium. Conversely, weak institutions generate weak interventions—those with low pf—and consequently fail to induce cooperative behavior. Hence, the institutional environment surrounding the intervention is crucial. Social change and welfare improvement arise only when strong statutes are implemented within strong institutional settings.

The two players in the model can be interpreted as two social classes: the fewer, more affluent Elite Class and the numerous, poorer Non-Elite Class. In the initial attractor (*D*, *D*), the Elite are the advantaged group, enjoying a higher initial income. They also understand that the post-reform distribution associated with the cooperative state (*C*, *C*) favors the Non-Elite, who would gain more from the reform. When institutions are weak, the Elite can offer a bribe to the authorities G, or to its key organs, to halt the reform and preserve the status quo. Weak institutions imply that the bribe required to make the authorities deviate from the reform program is finite—well within the Elite's ability to pay while still remaining better off than in the reformed state (*C*, *C*).

By contrast, the Non-Elite cannot mount an effective counter-lobby due to Olson's [1965] "tyranny of the minority": their large numbers and low incomes make it extremely difficult to coordinate contributions and produce a credible monetary offer. This asymmetry in credible commitment pushes a weak *G* to favor the Elite's lobby, causing the reform initiative—intended to raise overall welfare—to collapse.

We illustrate this asymmetry through the example of a franchised monopoly. The Non-Elite, as the much larger consumer class, cannot credibly commit to compensating the monopoly franchise holder for operating at a more socially desirable output and price, even when the potential surplus gains (including the deadweight loss) are sufficient to cover the compensation. A similar asymmetry arises in the legislative arena: even if the legislature seeks to support the Non-Elite by combining electoral pressure with a monetary proposal, the Elite may still raise their monetary offer to outweigh the legislative bias. Thus, whether in regulatory or legislative settings, the Elite's greater coherence and resources allow them to outmaneuver the Non-Elite, blocking welfare-enhancing reforms when institutions are weak.

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Nationalizing the minimum wage: Can the Philippines take the toll?

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The Philippines' minimum wage debate has intensified following the 2025 passage of House Bill (HB) 11376, which marked the first legislated wage increase in 36 years after the original HB 7787 proposal stalled. While regional wage boards have struggled to keep pace with the economic disruptions associated with the Tax Reform for Acceleration and Inclusion (TRAIN) law and the Coronavirus disease 2019 (COVID-19), labor groups continue to advocate for national standardization. This study employs a regional wage partial computable general equilibrium (CGE) model to evaluate four national minimum wage scenarios. Implementing the proposed ₱750 daily wage without productivity adjustments yields severe economic contraction, with real GDP declining 8.31 percent. Furthermore, formal sector employment is projected to fall 37 to 64 percent across regions, leading to displacement of 44,701 to 101,824 workers to informal markets. Even with 20 percent productivity gains, real GDP still contracts 4.96 percent. Regional inflation varies dramatically from -2.98 percent in NCR to 13.07 percent in ARMM, with services sector producer prices increasing up to 88.5 percent. Despite these wage increases, poverty reduction remains minimal at 0.3 to 0.5 percent, while real incomes for informal workers decline 14 to 31 percent due to the labor influx. Only the moderate scenario, which aligns wages to NCR levels (₱515) with ten percent productivity gains, limits GDP decline to 1.46 percent. The simulations confirm theoretical predictions that downward wage rigidity creates substantial formal-informal labor reallocation. Results strongly caution against dramatic uniform wage increases without corresponding productivity enhancements and suggest the need for gradual, regionally differentiated adjustments coupled with complementary policies to formalize employment and boost productivity.

JEL classification: J38, J62, J23
Keywords: partial computable general equilibrium, national minimum wage, poverty effects, regional wage modelling

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1. Introduction and review of literature

The minimum wage remains one of the most contentious labor market policies in the Philippines, with debates intensifying amid post-pandemic inflation and growing inequality. While basic labor economics traditionally characterizes minimum wages as creating market inefficiencies through surplus labor and unemployment [Neumark and Wascher 2007], recent evidence suggests more nuanced effects depending on market structure, institutional design, and complementary policies (Dube [2019]; Manning [2021]). The trade-off between ensuring living standards and maintaining employment has become increasingly complex as global economic disruptions reshape labor markets.

The Philippine minimum wage debate reached a critical juncture with House Bill (HB) No. 7787, filed by the Makabayan Bloc in May 2018, which proposed a ₱750 daily national minimum wage and the abolition of the regional wage board system [Cepeda 2018]. Though this specific bill stalled, similar legislative efforts culminated in the historic passage of HB 11376 in June 2025, authorizing a ₱200 across-the-board increase—the first legislated minimum wage adjustment in 36 years [Flores 2025]. This legislative action emerged from widespread dissatisfaction with the regional wage boards' inability to keep pace with inflation, particularly following the regressive impacts of the Tax Reform for Acceleration and Inclusion (TRAIN) law.

Although HB 7787 pertained to the 17th Congress and proposed a uniform ₱750 floor, the concept of a nationwide minimum wage has been re-filed in later Congresses in new forms (e.g., proposals for ₱1,200 or alternative implementation designs in 2025). These later proposals are distinct measures, not continuations of HB 7787. Accordingly, the present analysis remains scoped to HB 7787's policy architecture; references to later proposals serve only to situate the ongoing debate and do not alter the modeling of the 2012-calibrated counterfactual examined in this paper.

The existing framework under Republic Act No. 6727, the Wage Rationalization Act, establishes Regional Tripartite Wages and Productivity Boards (RTWPBs) that determine wages based on poverty levels, cost of living, and employment conditions in each region. This decentralized approach has produced substantial wage disparities, with daily minimum wages ranging from ₱361 in Bangsamoro Autonomous Region in Muslim Mindanao (BARMM) to ₱695 in the National Capital Region (NCR) as of 2025 [Philippine News Agency 2024]. Critics argue this system has failed to provide living wages, with IBON Foundation estimating that NCR workers require ₱1,221 daily for a family of five—leaving a ₱576 gap even after recent adjustments [Cruz 2023].

Both classic and recent evidence suggest that the degree of coordination in wage setting often matters more than whether bargaining is formally centralized or decentralized. Calmfors & Driffill [1988] predict a U-shaped relationship, where highly centralized or highly decentralized systems yield better macro economic outcomes than hybrid arrangements. Newer Organisation for Economic Co-operation and Development (OECD) or International Labour Organization (ILO) research [2023] refines this view, emphasizing the value of coordinated frameworks with built-in flexibility (e.g., sectoral or national frameworks or productivity clauses) to allow economies to balance wage moderation with equity and micro-level adjustment. In contexts with wide regional variation in prices and productivity, such as the Philippines, this points toward a national wage floor to support equity and poverty protection, complemented by sectoral or firm-level bargaining (or wage orders) that can calibrate pay to local productivity and demand conditions.

International experience with national minimum wage systems provides valuable lessons for Philippine policy makers. Germany's 2015 transition from sectoral bargaining to a national minimum wage demonstrated that unified systems can achieve wage convergence with minimal employment losses, contradicting traditional economic predictions (Caliendo et al. [2018]; Bossler and Gerner [2019]). Similarly, recent evidence from the United States shows employment elasticities near zero in concentrated labor markets, suggesting minimum wage effects depend critically on market structure [Azar et al. 2024]. However, developing country contexts present unique challenges, as Fields [2019] notes that large informal sectors can limit policy effectiveness and create unintended spillover effects.

The proposed nationalization of minimum wages in the Philippines marks a significant departure from the country's longstanding regional approach and would place it among a relatively small group of countries with fully uniform national wage floors. Internationally, a wide spectrum of minimum wage architectures are evident, from highly centralized national systems to strongly decentralized regional models. The United Kingdom, for example, adopted a national minimum wage in 1999, replacing the previous sector-based Wages Councils, while still maintaining age-specific differentials and recently introducing higher London-specific rates [Low Pay Commission 2023]. The United States presents a hybrid system where a federal minimum wage floor of $7.25/hour (unchanged since 2009) coexists with state and municipal minimum wages, resulting in substantial geographic variation—from the federal minimum in some Southern states to over $15/hour in cities like Seattle and San Francisco [Neumark 2019]. Canada also relies on provincial minimum wages which ranged from C$ 13.00 to C$ 16.77 in 2024, recognizing significant cost-of-living differences across provinces. China operates a tiered structure with minimum wages varying across provinces and even within provinces by urban-rural classification, explicitly acknowledging regional economic disparities [Jia and Zhang 2013]. Large developing economies with substantial informal sectors likewise tend to adopt decentralized systems: India maintains state-level and occupation-specific minimum wages, while Indonesia's district-level system (*kabupaten/kota*) generates hundreds of different minimum wage rates.

Against this backdrop, the Philippines' proposal for a uniform ₱750 national minimum wage is unusual. Even countries with "national" wage floors typically incorporate regional, sectoral, or demographic variation to account for cost-of-living and productivity differences. The Philippines' current system of regional wage boards aligns more closely with decentralized frameworks of the United States, Canada, and China, where wage-setting institutions adjust to local economic conditions.

The Coronavirus disease 2019 (COVID-19) pandemic and subsequent inflationary surges have fundamentally altered minimum wage dynamics globally. According to the ILO, real minimum wages declined by 2.2 percent to 44.7 percent across Asia-Pacific countries between 2020 and 2022, as inflation outpaced nominal adjustments [ILO 2023]. The Philippines experienced similar challenges, with peak inflation reaching 8.7 percent in January 2023, eroding purchasing power despite nominal wage increases [Asian Development Bank 2023]. These disruptions underscore the limitations of traditional adjustment mechanisms and the need for more responsive institutional frameworks.

Recent methodological advances have substantially improved our understanding of minimum wage effects. Meta-analyses of 588 studies find consistent employment elasticities of -0.1 to -0.3, with 90 percent of comprehensive studies finding minimal disemployment effects [Wolfson and Belman 2019]. Spatial equilibrium models reveal that worker mobility and regional spillovers significantly affect policy outcomes [Monras 2019], while dynamic computable general equilibrium (CGE) models incorporating efficiency-wage mechanisms indicate potential positive GDP effects of 3.9 to 4.6 percent in middle-income countries [Adam and Buffie 2020]. These advances suggest that carefully designed minimum wage policies can achieve distributional goals with limited efficiency costs. Moreover, numerous studies find that statutory minimum wages tend to raise wages at the bottom with limited aggregate employment losses, while inducing meaningful reallocation across firms and regions. For Germany's 2015 nationwide reform, Dustmann et al. [2022] document sizable wage increases and negligible net employment effects, accompanied by reallocation from smaller/low-pay to larger/higher-pay establishments. Similar patterns—wage gains, inequality compression, and muted employment effects—appear in large developing economies when enforcement is non-trivial: Indonesia [Hohberg & Lay 2015], Brazil [Engbom & Moser 2022], and India where impacts vary with enforcement intensity [Soundararajan 2019]. Collectively, this evidence supports modeling strategies that allow for price pass-through, reallocation, hours adjustments, vacancy dynamics, regional heterogeneity, and imperfect compliance.

Fiscal reforms have also interacted with wage policy debate. The 2018 TRAIN law implementation added complexity to these discussions. Despite the law exempting low-income earners from income tax, increased excise taxes on fuel and other commodities disproportionately affected poor households.

Philippine Institute for Development Studies (PIDS) research estimates that the reform increased poverty incidence by 0.26 percentage points even with cash transfers, contradicting government projections [2019]. This experience underscores the importance of considering minimum wage policy within broader fiscal and social protection frameworks.

Given this evolving context, assessing a potential national minimum wage system for the Philippines requires sophisticated analytical tools capable of capturing inter-market interactions and regional heterogeneity. The regional wage model (RWM) used in this study incorporates labor market segmentation, region-specific productivity and price wedges, formal-informal interactions, and general equilibrium effects to assess policy impacts on production, inflation, poverty, and employment.

The study has four main objectives: (1) estimate the effects of a national minimum wage on production, employment, inflation, and poverty across regions using a partial CGE framework; (2) analyze labor market adjustments between formal and informal sectors under alternative productivity scenarios; (3) evaluate distributional impacts through poverty microsimulations using Family Income and Expenditure Survey (FIES) 2012 data; and (4) propose evidence-based policy designs that balance wage adequacy with employment sustainability in the Philippines.

The remainder of the paper is organized as follows. Section 2 outlines the (RWM), including its consumption framework, production structure, and labor market dynamics under minimum wage constraints. The model features downward wage rigidity in formal markets and endogenous labor flows to the informal sector. Section 3 presents four policy simulations: (1) implementing HB 7787's ₱750 national minimum wage without productivity changes, (2) adding a fixed 20 percent productivity improvement, (3) allowing proportional productivity responses, and (4) applying NCR-level wages nationally with moderate productivity gains. Associated poverty microsimulations assess distributional effects across urban and rural populations. Section 4 concludes with policy recommendations informed by both simulation results and international evidence.

2. Regional wage model

A nationally legislated minimum wage is an economy-wide shock whose incidence propagates through interlinked product and factor markets, regional price–productivity differentials, tax–transfer systems, and firm and household reallocation margins. A CGE model is designed to track these multi-market feedbacks under a consistent macroeconomic closure, covering goods, factors, and government budget, making it well-suited for quantifying distributional incidence, sectoral spillovers, and price effects at national scale.

We treat search-and-matching models as complementary rather than competing tools. Recent heterogeneous-firm and search-based frameworks for Germany show that minimum wages can raise wages and productivity with limited employment losses at moderate "bite" levels, while also inducing meaningful reallocation. These insights help discipline key elasticities and reallocation margins in our CGE calibration (Dustman et al. [2022]; Drechsel-Grau [2023]). In short, CGE provides the economy-wide aggregation while structural/search evidence anchors behavioral responses and heterogeneity.

A CGE model is often the better tool when the goal is to quantify aggregate and distributional effects consistently across input-output linkages, regional price-productivity wedges, price pass-through, household taxes and transfers, and government budget closure. CGE explicitly enforces market-clearing and fiscal consistency, can report sectoral and regional spillovers, and is widely used by policy institutions for exactly this type of whole-economy counterfactual. Alternative models typically excel on narrower margins. For example, search-and-matching models richly micro-found hiring frictions and reallocation but do not natively track multi-market fiscal/price feedbacks, and microsimulations lack general-equilibrium interactions. We also incorporate poverty microsimulations to better understand the impact on the income distribution.

We acknowledge concerns that CGE outcomes can be sensitive to model structure such as wage-curve and labor-demand elasticities, macro-closure rules and assumptions regarding regional wage rigidities. Poorly specified models may mechanically predict job losses [Storm & Isaacs 2016]. Recent studies, therefore, calibrate labor and demand elasticities to reflect ex-post evidence of muted net employment effects alongside reallocation (e.g., Germany 2015), test robustness under alternative closures. and incorporate imperfect compliance and informal-sector margins. Many also cross-validate reallocation implications against search-and-matching results (Dustmann et al. [2022]; Drechsel-Grau [2023]).

This study adopts a regional wage CGE model following the structure of Cororaton et al. [2017], with modifications to better reflect Philippine context. The model features a consumption structure based on a representative household's utility maximization process and a production structure based on regional firms' cost minimization decisions.

The labor market is segmented into the formal sector and the informal sectors with sector-specific wage differentials and downward regional wage rigidities in the formal sector at a regional level. This explicitly allows for labor movement between these two sectors due to changes in the minimum wage, thus enabling wages and employment patterns to adjust both within and across regions. Finally, a poverty microsimulation, using FIES 2012, translates macro- and meso-level shocks, allowing us to compute for household-level distributional and poverty outcomes.

2.1. Consumption framework

We follow a two-stage nested constant elasticity of substitution (CES) structure similar to Cororaton et al. [2017]. The first stage of the utility maximization process is a function of the aggregation of various items in four sectors. The utility function follows CES format for ease of computation, subject to a budget constraint.

$$maxU = \left(\sum_i \alpha_i^{\frac{1}{\sigma_1}} \cdot x_i^{\frac{\sigma_1 - 1}{\sigma_1}} \right)^{\frac{\sigma_1}{\sigma_1 - 1}} \tag{1}$$

$$m = \sum_i CP_i \cdot x_i \ . \tag{2}$$

The equations above suggest that the representative household's utility (which is in the CES form) is subject to some budget or income constraint m. Where x_i represents goods from i (agriculture, manufacturing, non-manufacturing and services), m is the income, CP_i is the consumer price of good x_i and σ_i is the elasticity of substitution in the first stage.

Specifying the utility maximization process using the Lagrange multiplier method, the Lagrange function is:

$$max\ L = \left(\sum_i \alpha_i^{\frac{1}{\sigma_1}} \cdot x_i^{\frac{\sigma_1 - 1}{\sigma_1}} \right)^{\frac{\sigma_1}{\sigma_1 - 1}} + \lambda \left(m - \sum_i CP_i \cdot x_i\right) . \tag{3}$$

The Marshallian demand function for a good i where i is derived using first-order conditions is:

$$x_i^* = m \cdot \frac{\alpha_i CP_i^{-\sigma_1}}{\sum_i \alpha_i CP_i^{1-\sigma_1}} \ . \tag{4}$$

The unit cost (UC) for the remainder of the study is obtained from the utility maximization process (UMP) and the Marshallian demand functions:

$$UC = \sum_i \left(\alpha_i CP_i^{1-\sigma_1}\right)^{\frac{1}{1-\sigma_1}} \ . \tag{5}$$

In the consumption framework, we further disaggregate each x_i into 17 products, representing the different products in the 17 regions of the country. We assume that there are 17 differentiated types of agricultural products, manufacturing products, non-manufacturing products, and services products, each representing one regional product. That regional product is denoted by $rx_{i,r}$ which represents an i product from a sector belonging to an r region.

The Marshallian demand function for a good $rx_{i,r}$ is:

$$rx_{i,r}^* = \frac{\delta_{i,r} rCP_{i,r}^{-\sigma_2} \left(CP_i \cdot x_i\right)}{\sum_r \delta_{i,r} rCP_{i,r}^{1-\sigma_2}} \ , \tag{6}$$

where a $rCP_{i,r}$ is the regional consumer price for a good $rx_{i,r}$ and the second stage elasticity of substitution σ_2, the unit cost, is derived as:

$$CP_i = \sum_i (\delta_{i,r} rCP_{i,r}^{1-\sigma_2})^{\frac{1}{1-\sigma_2}} \quad . \tag{7}$$

2.2. Production framework

The production framework follows a similar two-stage nested CES function based on a cost minimization procedure subject to a projected CES production where the factor inputs are aggregated labor and capital. In the second stage of the two-stage nested CES function, we disaggregate labor into two types, namely, Type 1, which is labor with at least a high school diploma, and Type 2, which is the rest of the employment available. As the model is static, the supply of both labor types is fixed.

In accordance with the regional wage boards, the regional labor market equilibrates the wages for the two types of labor. In a labor market, of course, the interactions between demand and supply would dictate the wage rate. However, as we are dealing with a fixed labor supply, we must still derive the demand for aggregate labor. The demand function for aggregate labor is a downward sloping form and is based on the framework of Decaluwe et al. [2000].

$$ALab_{i,r} = \left(\frac{rgdp_{i,r}}{\beta_{i,r}}\right)\left(\frac{\beta_{i,r}\theta_{i,r}PP_{i,r}}{AW_{i,r}}\right)^{\epsilon_{1(i,r)}} \tag{8}$$

where the regional gross domestic product is $rgdp_{i,r}$, an exogenous production scale parameter disaggregated per region and sector is $\beta_{i,r}$, the share of aggregate labor per region and sector is $\theta_{i,r}$, the producer price of a regional product is $PP_{i,r}$, the aggregate wage is $AW_{i,r}$, and the elasticity of substitution in the first stage is $\epsilon_{1(i,r)}$.

The demand function for capital ($CAP_{i,r}$) is symmetric to the aggregate labor demand function.

$$Cap_{i,r} = \left(\frac{rgdp_{i,r}}{\beta_{i,r}}\right)\left(\frac{\beta_{i,r}(1-\theta_{i,r})PP_{i,r}}{RK_{i,r}}\right)^{\epsilon_{1(i,r)}} \tag{9}$$

where $RK_{i,r}$ is the rental rate of capital and $Cap_{i,r}$ denotes a capital input in a sector i for a given region r. The producer price or the unit cost may be expressed as a function of the aggregate wage and the rental rate of capital:

$$PP_{i,r} = \left(\frac{1}{\beta_{i,r}}\right)\left[\theta_{i,r}^{\epsilon_{1(i,r)}}(AW_{i,r})^{1-\epsilon_{1(i,r)}} + (1-\theta_{i,r}^{\epsilon_{1(i,r)}})(RK_{i,r})^{1-\epsilon_{1(i,r)}}\right]^{\frac{1}{1-\epsilon_{1(i,r)}}} \quad . \tag{10}$$

In the second stage, labor is delineated into Type 1 laborer (with at least a high school diploma) and the Type 2 labor (the rest of employment). In a typical labor market, each type of labor will have a certain demand based on the prevalent market conditions present. The demand functions for the two labor types are assumed to be symmetric. The demand for Type 1 labor ($Lab_{i,r}^1$) is

$$Lab^1_{i,r} = \left(\frac{ALab_{i,r}}{\lambda_{1(r)}\mu_{i,r}} \right) \left[\frac{\lambda_{1(r)}\mu_{i,r}AW_{i,r}\gamma_{i,r}}{w^1_r} \right]^{\epsilon_{2(i,r)}}, \quad (11)$$

The demand for Type 2 labor ($Lab^2_{i,r}$) is

$$Lab^2_{i,r} = \left(\frac{ALab_{i,r}}{\lambda_{2(r)}\mu_{i,r}} \right) \left[\frac{\lambda_{2(r)}\mu_{i,r}AW_{i,r}(1-\gamma_{i,r})}{w^2_r} \right]^{\epsilon_{2(i,r)}}, \quad (12)$$

where w^1_r and w^2_r denote regional wage rates for Type 1 and Type 2 laborers, respectively. Note that regional wages are determined formally by regional wage boards that base their decisions on specific economic indicators. The model also incorporates the labor-efficiency parameters $\lambda_{1(r)}$ and $\lambda_{2(r)}$ for Type 1 and a Type 2 workers along with $\epsilon_{2(i,r)}$, the elasticity of substitution in the second stage of the nested CES structure. As established by Annabi et al. [2006], this is a central focus on minimum wage CGE or partial CGE simulations.

In theory, increases in the minimum wage raise worker compensation and can bolster higher levels of productivity. In many aspects, the increase in the productivity may lead to higher returns and offset the negative returns or effects of the minimum wage increase which have been known to decrease employment.

The labor demand functions specified in Equations (8), (11), and (12) incorporate a structural inverse relationship between wages and labor demand, which warrants brief discussion given recent empirical debates in the minimum wage literature. While studies by Card and Krueger [1994], Dube et al. [2010], and Cengiz et al. [2019] have challenged the traditional competitive model by finding minimal disemployment effects from modest minimum wage increases in developed economies, these findings typically apply to small, incremental changes ranging from five percent to 15 percent in contexts with substantial labor market frictions and monopsony power.

Other studies from Neumark and Wascher [2007] and Neumark and Shirley [2022] demonstrate that disemployment effects remain evident in developing countries with large informal sectors and become pronounced for larger wage increases that substantially exceed productivity levels. The minimum wage increases examined in this study range from 46 percent (NCR) to 167 percent (ARMM)—far beyond the marginal adjustments studied in the new minimum wage literature. At these magnitudes, even models incorporating efficiency wages or monopsony elements predict substantial labor demand reductions as any existing wage premiums or rents are exhausted. Therefore, while we recognize that small incremental changes in a growing economy might produce negligible employment effects due to turnover costs and labor market frictions, the dramatic wage hikes proposed in HB 7787 justify our classical downward-sloping labor demand specification.

We let $\gamma_{i,r}$ denote the share parameter and $\mu_{i,r}$ be a scale parameter required for model calibration. The second-stage elasticity of substitution is given by $\epsilon_{2(i,r)}$. Using the two labor demand functions, we can express the aggregate wage (unit cost) as a function of regional wages, share parameters, and labor-efficiency terms:

$$AW_{i,r} = \left(\frac{1}{\mu_{i,r}}\right)\left[\gamma_{i,r}^{\epsilon_{2(i,r)}}\left(\frac{w_r^1}{\lambda_{1(r)}}\right)^{1\text{-}\epsilon_{2(i,r)}} + (1-\gamma_{i,r}^{\epsilon_{2(i,r)}})\left(\frac{w_r^2}{\lambda_{2(r)}}\right)^{1\text{-}\epsilon_{2(i,r)}}\right]^{\frac{1}{1\text{-}\epsilon_{2(i,r)}}} . \quad (13)$$

2.3. Minimum wage in the regional wage model

Following Decaluwe et al. [2000], the minimum wage mechanism is incorporated through the second stage of the nested CES model production structure. Type 1 laborers generally operate in a formal labor market vis-à-vis the Type 2 laborers who work in an informal market, reflecting the assumed productivity or ability distinction between the two groups.

A central assumption is that the Type 1 laborer has a higher wage w_r^1 compared to a Type 2 laborer's wage w_r^2. This suggests that equilibrium wage between the fixed labor supply and the labor demand for each type of laborer is higher for a Type 1 laborer than a Type 2 laborer.

We also assume that each labor type can freely move across different sectors i within a region. This means that a laborer or a labor factor input may easily be transferred from agriculture to manufacturing to services and so on without any retraining in a region. However, we will restrict the movement of labor across r. This means that a laborer or a labor factor input at region r will always remain in that region r.

FIGURE 1. Illustrating the two types of laborers

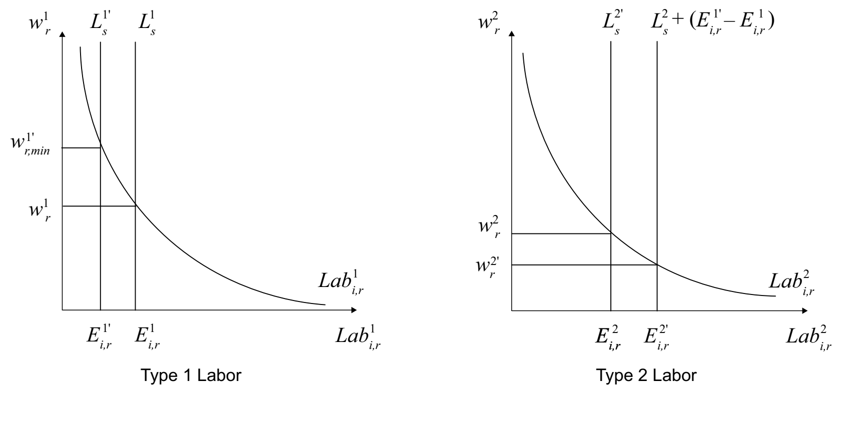


Figure 1 illustrates the labor markets for Type 1 and Type 2 workers. Each market features fixed labor supplies and similar downward-sloping demand curves. As noted, the Type 1 wage lies above Type 2 wage.

As discussed by Cororaton et al. [2017], minimum wage laws will create downward rigidity in the market for a Type 1 laborer. Analyzing the immediate effects of the imposition of a minimum wage $w_{r,\ min}^1$ is straightforward, highlighting that a higher minimum wage will force local firms to layoff laborers due to the increase in wage for the equilibrating or clearing conditions in the

Type 1 labor market to be satisfied. Graphically speaking, firms initially employ $E^1_{i,r}$ but due to the increase in minimum wage, the employment reduces to $E^{1'}_{i,r}$. The newly laid off or unemployed Type 1 laborers will have no choice but to compete for a job or employment in the Type 2 labor market. Since workers will transfer from Type 1 labor to Type 2 labor, they will inevitably increase the supply of workers in Type 2 labor. Due to the labor transfer, there will be downward pressure on the wage of a Type 2 labor from w^2_r to $w^{2'}_{i,r}$. Hence, due to the transfer of labor from Type 1 to Type 2 labor market, the supply of Type 2 labor will now be endogenous. It now depends on both the fixed component of Type 2 labor supply and the number of displaced Type 1 workers, which is itself a function of the magnitude of the wage increase. We formally express these mathematical relationships below following Decaluwe et al. [2000] and Annabi et al. [2006].

We first note that the minimum wage in a region is less than or equal to the true regional wage. This is because not every worker in the Type 1 labor market is paid the minimum wage.

$$w^1_{r,\,min} \leq w^1_r \tag{14}$$

This in turn will lead to an unemployment value in the Type 1 labor market which is greater than or equal to zero.

$$Unemployment^1_r \geq 0 \tag{15}$$

These two conditions define the orthogonality constraint for the minimum wage which suggests that the following relationship should hold.

$$(w^1_r - w^1_{r,\,min}) \cdot Unemployment^1_r = 0 \tag{16}$$

There are two main conditions for the constraint to still hold. The first condition happens when w^1_r is greater than the exogenous $w^{1'}_{r,\,min}$. If this is the case, then the unemployment in Type 1 would not exist since this is a reduction in the minimum wage. The second condition is when there are minimum wage increases, which occur when $w^{1'}_{r,\,min}$ is greater than or equal to w^1_r, which suggests that there will be a displacement of laborers from Type 1 to Type two suggesting that $Unemployment^1_r > 0$.

In the presented graph, we can see that $Unemployment^1_r$ is represented by the difference in the initial level of employment in Type 1 labor market given as $\sum_i E^{1'}_r - \sum_i E^1_r$.

$$Unemployment^1_r = \sum_i E^{1'}_r - \sum_i E^1_r \tag{17}$$

This market equilibrium condition would be labor demand for all sectors in a region on the left-hand side and labor supply on the right-hand side accounting for the increases in minimum wage. Note that we let $SLab^1_r$ and $SLab^2_r$ be the fixed labor supply for the Type 1 and the Type 2 labor markets for each region. The market equilibrium for the two labor markets can be formed through the following:

$$\sum_i {}^1 Lab_{i,r} = SLab_r^1 - Unemployment_r^1 \quad (18)$$

$$\sum_i {}^2 Lab_{i,r} = SLab_r^2 + Unemployment_r^1 \quad (19)$$

2.4. Product market framework

The product market framework is directly adopted from Annabi et al. [2006] which suggests that the market for commodities clears when there is an equality between the demand of a representative household and the regional gross domestic product. This is given as

$$rx_{i,r}^{*} = rgdp_{i,r} \quad (20)$$

$$\frac{\delta_{i,r}\, rCP_{i,r}^{-\sigma_2}(CP_i \cdot x_i)}{\sum_r \delta_{i,r}\, rCP_{i,r}^{1-\sigma_2}} = rgdp_{i,r} \ . \quad (21)$$

Using the market clearing condition given above, we can compute for the regional price $rCP_{i,r}$ which is given by the form below:

$$rCP_{i,r} = Margin_{i,r} + PP_{i,r} \ . \quad (22)$$

The consumer price of the regional product is the sum of the producer price and a given trade margin which accounts for various external costs such as taxes, storage, and transportation costs.

2.5. Brief overview of the data

The data for the study used the Nominal GDRP and the Real GDRP which was disaggregated into four sectors from the initial twelve sectors as stipulated in the study. To derive the column on labor compensation, regional employment data from the Philippine Statistical Yearbook (PSY) was used where the data was segmented into the two labor market types used in the study, which was then further disaggregated into the four sectors using factors from the Labor Force Survey (LFS). The share parameters that were used to disaggregate between the two markets were from the October releases of the LFS. The average daily pay for Type 1 and Type 2 were computed using the LFS and were multiplied with the share parameters to obtain the daily compensation. The wage ratio is simply the ratio between the Type 1 and Type 2 daily compensations. Since the value is greater than unity, Type 1 labor has a higher wage w_r^1 than Type 2 labor, w_r^2.

TABLE 1. Data used in calibrating the RWM

			Nominal	Real	Labor compensation[3]		Wage ratio
			GRDP[1]	GRDP[2]	Type1	Type 2	Type 1/Type 2
Region 1	Ilocos Region	Agriculture	91.0	52.2	8.8	8.2	1.05
		Manufacturing	18.7	11.2	2.8	1.0	1.45
		Non-Manufacturing	84.0	47.1	5.8	2.5	1.44
		Services	192.6	113.8	45.7	4.9	2.44
		Total	386.2	224.2	63.1	16.6	1.60
Region 2	Cagayan Valley	Agriculture	91.1	48.3	7.1	12.6	1.03
		Manufacturing	3.0	1.8	1.1	0.5	1.31
		Non-Manufacturing	29.3	14.7	1.8	1.2	1.17
		Services	105.0	63.0	25.3	3.2	2.59
		Total	228.4	127.8	35.4	17.5	1.52
Region 3	Central Luzon	Agriculture	191.2	112.7	8.7	15.3	1.04
		Manufacturing	351.2	221.1	16.5	5.0	1.47
		Non-Manufacturing	111.6	61.1	11.7	8.5	1.20
		Services	463.8	266.9	114.3	22.1	2.01
		Total	1,117.7	661.9	151.2	50.9	1.43
Region 4a	CALABARZON	Agriculture	115.9	71.2	8.1	15.4	1.02
		Manufacturing	1,001.1	661.5	41.6	6.8	1.59
		Non-Manufacturing	188.9	101.1	14.0	9.2	1.25
		Services	676.8	401.1	169.3	23.3	2.35
		Total	1,982.7	1,234.9	233.0	54.7	1.55

TABLE 1. Data used in calibrating the RWM (continued)

			Nominal	Real	Labor compensation[3]		Wage ratio
			GRDP[1]	GRDP[2]	Type1	Type 2	Type 1/Type 2
Region 4b	MIMAROPA	Agriculture	53.5	27.1	4.3	11.5	1.12
		Manufacturing	8.7	5.7	0.9	1.1	1.17
		Non-Manufacturing	57.1	34.5	1.5	1.6	1.24
		Services	83.3	50.2	22.1	3.7	2.50
		Total	202.6	117.5	28.7	17.8	1.51
Region 5	Bicol Region	Agriculture	65.9	33.4	5.3	15.3	1.02
		Manufacturing	7.9	5.0	1.9	2.1	1.22
		Non-Manufacturing	49.1	25.0	2.8	4.0	1.02
		Services	140.4	81.4	40.7	8.3	2.47
		Total	263.3	144.8	50.7	29.7	1.44
Region 6	Western Visayas	Agriculture	122.9	61.7	7.9	15.6	1.19
		Manufacturing	34.1	22.9	3.4	1.8	1.61
		Non-Manufacturing	67.6	36.1	5.0	3.6	1.19
		Services	278.8	163.3	62.1	9.6	2.46
		Total	503.3	284.0	78.5	30.6	1.61
Region 7	Central Visayas	Agriculture	56.0	28.2	4.0	14.7	1.25
		Manufacturing	173.8	113.2	9.7	4.3	1.54
		Non-Manufacturing	112.3	59.6	4.6	5.3	1.60
		Services	467.1	256.0	61.5	12.7	2.41
		Total	809.3	457.0	79.8	37.2	1.70

TABLE 1. Data used in calibrating the RWM (continued)

			Nominal	Real	Labor compensation[3]		Wage ratio
			GRDP[1]	GRDP[2]	Type1	Type 2	Type 1/Type 2
Region 8	Eastern Visayas	Agriculture	52.6	27.3	3.0	12.4	1.08
		Manufacturing	41.5	28.8	1.0	1.2	1.35
		Non-Manufacturing	61.5	33.2	1.8	1.8	1.32
		Services	103.9	60.3	26.0	5.9	3.01
		Total	259.5	149.6	31.9	21.3	1.69
Region 9	Zamboanga Pen.	Agriculture	62.2	30.4	3.1	10.4	1.14
		Manufacturing	56.6	38.8	1.2	1.0	1.25
		Non-Manufacturing	26.0	14.6	1.4	1.8	1.14
		Services	111.3	63.1	23.6	4.5	2.99
		Total	256.0	146.8	29.3	17.8	1.63
Region 10	N. Mindanao	Agriculture	120.5	62.9	5.8	13.7	1.24
		Manufacturing	82.7	56.0	2.9	1.2	1.63
		Non-Manufacturing	70.3	35.5	3.0	2.3	1.37
		Services	206.0	112.9	36.7	6.2	2.58
		Total	479.5	267.4	48.4	23.3	1.70
Region 11	Davao Region	Agriculture	101.9	40.5	6.0	12.9	1.37
		Manufacturing	88.0	61.1	2.8	1.4	1.41
		Non-Manufacturing	61.1	32.1	3.3	3.4	1.30
		Services	263.2	147.1	36.3	6.9	2.23
		Total	514.1	280.9	48.4	24.6	1.58

TABLE 1. Data used in calibrating the RWM (continued)

			Nominal	Real	Labor compensation[3]		Wage ratio
			GRDP[1]	GRDP[2]	Type1	Type 2	Type 1/Type 2
Region 12	SOCCSKSARGEN	Agriculture	109.8	53.9	7.9	13.4	1.58
		Manufacturing	67.2	47.0	2.4	1.6	0.98
		Non-Manufacturing	35.6	19.5	1.5	1.1	1.41
		Services	129.8	74.7	32.5	4.5	3.24
		Total	342.5	195.1	44.4	20.6	1.80
Region 13	CARAGA	Agriculture	33.7	17.5	3.3	10.1	0.98
		Manufacturing	3.9	2.6	1.4	1.0	1.14
		Non-Manufacturing	37.8	29.6	2.7	2.6	1.23
		Services	73.3	41.3	22.2	4.9	2.28
		Total	148.7	91.1	29.6	18.6	1.41
Region 14	ARMM	Agriculture	63.6	29.8	3.9	11.5	1.40
		Manufacturing	1.0	0.6	0.2	0.2	1.32
		Non-Manufacturing	4.3	2.3	0.3	0.3	1.34
		Services	32.2	17.4	12.7	3.8	2.78
		Total	101.1	50.2	17.0	15.9	1.71
Region 15	CAR	Agriculture	24.0	13.0	3.0	5.1	1.12
		Manufacturing	82.3	51.8	0.9	0.2	1.61
		Non-Manufacturing	31.2	13.7	2.2	1.3	1.29
		Services	90.1	50.4	17.3	1.5	2.27
		Total	227.6	128.9	23.4	8.2	1.57

TABLE 1. Data used in calibrating the RWM (continued)

			Nominal	Real	Labor compensation[3]		Wage ratio
			GRDP[1]	GRDP[2]	Type1	Type 2	Type 1/Type 2
Region 16	NCR	Agriculture	9.4	5.0	0.7	0.7	1.38
		Manufacturing	521.1	326.4	27.7	4.4	1.39
		Non-Manufacturing	310.9	166.8	18.0	7.1	1.36
		Services	3,832.8	2,111.4	238.7	22.8	2.02
		Total	4,674.2	2,609.5	285.1	34.9	1.54

Source: Philippine National Accounts, and Labor Force Survey.
[1] ₱ billion
[2] 2000 prices
[3] ₱ billion

2.6. Model and data limitations

Given the structure of the model, several limitations are important for interpreting our results. First, the model assumes a competitive labor market with full compliance and strict enforcement of the minimum wage. This assumption allows for a transparent mapping from policy changes to economic outcomes but necessarily abstracts from firm heterogeneity, imperfect markets, informality, and alternative margins of adjustment, which are more realistic. As a result, the model likely overstates disemployment effects relative to more realistic settings in which firms possess labor market power or adjust along non-employment margins. Our results should be interpreted as upper-bound estimates of the employment effects of minimum wage increases under full compliance and competitive wage-setting.

Second, the model is calibrated to a 2012 benchmark dataset, which may limit its precision when simulating minimum wage policies in later years, particularly the 2018 and 2024 counterfactuals. Ideally, the model would be recalibrated as newer data become fully harmonized and validated. However, 2012 remains the most recent year for which a complete and internally consistent social accounting matrix is available. Moreover, many key behavioral and technological parameters that govern substitution patterns and labor demand evolve only gradually over time, so the 2012 calibration remains informative for medium-run comparative-static analysis. To the extent that later years exhibit higher informality, weaker enforcement, or stronger employer market power, our simulations may overstate true employment losses, reinforcing the interpretation of our results as conservative upper-bound estimates.

3. Performing the simulations

We conducted a series of simulations designed to assess the potential effects of HB 7787. Consistent with the core intent of the House Bill, the simulations imposed the abolition of the regional wage boards and replaced all regional wages with a sole national minimum wage. The model design does not account for differences in agricultural and non-agricultural minimum wages, reflecting a simplying assumption of uniform wage floors across sectors.

Assumptions on productivity draw from average labor productivity gains documented in Annabi et al. [2006], though we acknowledge that these may not fully capture the context-specific dynamics of the Philippine labor market. The assumption of productivity gains following wage increases has theoretical support in efficiency wage theory, which posits that higher wages can enhance worker productivity through improved nutrition, reduced shirking, lower turnover costs, and enhanced morale (Shapiro and Stiglitz [1984]; Akerlof and Yellen [1986]).

Empirical evidence suggests these effects exist, though their magnitude varies considerably by context. For instance, Mas [2006] found evidence of productivity responses to wage changes among police officers, while Riley and Bondibene [2017] documented positive productivity effects from minimum wage increases in the UK's care home sector. However, the choice of uniform 10 to 20 percent productivity increases across all sectors and regions appears conservative relative to wage increases of 46 to 167 percent, which is appropriate given the uncertainty around such effects and the lack of Philippines-specific estimates.

3.1. Simulation 1

Simulation 1 is the most direct yet most restrictive simulation of HB 7787. We merely simulate and adjust the minimum wage of all regions in the Philippines to ₱750 as proposed by the proponents of the aforementioned house bill. Hence, the highest reported minimum wage for each region were all adjusted to the proposed national minimum wage. We have no adjustments in labor productivity and also no changes in labor supply due to changes in the minimum wage. We also do not adjust factor productivities and capital stocks of the sectors.

We refer to Table 2 for the initial calibration on the changes of the wage and the immediate change in the Type 2 labor market. We can also see the amount of labor that will shift from one labor market to another for each region.

TABLE 2. Simulation 1 labor market shifts and wage changes

	Wages, percent change		Labor shifts (level)	
	Type 1	**Type 2**	**Type 1**	**Type 2**
NCR	46.0000	-72.1166	-87.5171	87.5171
CAR	150.0000	-57.8948	-13.0609	13.0609
Ilocos Region	141.0000	-64.2325	-34.5854	34.5854
Cagayan Valley	120.0000	-48.0809	-18.4574	18.4574
Central Luzon	97.0000	-58.6436	-70.1206	70.1206
CALABARZON	87.5000	-64.0032	-101.8244	101.8244
MIMAROPA	150.0000	-45.7622	-16.3779	16.3779
Bicol	158.0000	-49.6610	-29.4586	29.4586
Western Visayas	105.0000	-51.8754	-38.0703	38.0703
Central Visayas	105.0000	-46.5260	-37.9112	37.9112
Eastern Visayas	146.0000	-41.3993	-17.8557	17.8557
Zamboanga	153.0000	-44.7174	-16.6519	16.6519
Northern Mindanao	121.0000	-46.3537	-24.8574	24.8574
Davao Region	120.0000	-47.1771	-24.6839	24.6839
SOCCSKARGEN	141.0000	-47.3205	-24.6874	24.6874
CARAGA Region	145.0000	-47.5902	-16.5933	16.5933
ARMM	167.0000	-35.6453	-10.4312	10.4312

In Table 2, we see the approximate recalibration of the minimum wage to ₱750 for all regions. Note that there is downward rigidity in the labor market for Type 1 which will subsequently cause a decrease in the wage of the Type 2 labor market. As illustrated, labor will shift from Type 1 to Type 2 due to lay offs triggered by increased costs.

FIGURE 2. Labor shifts in Simulation 1

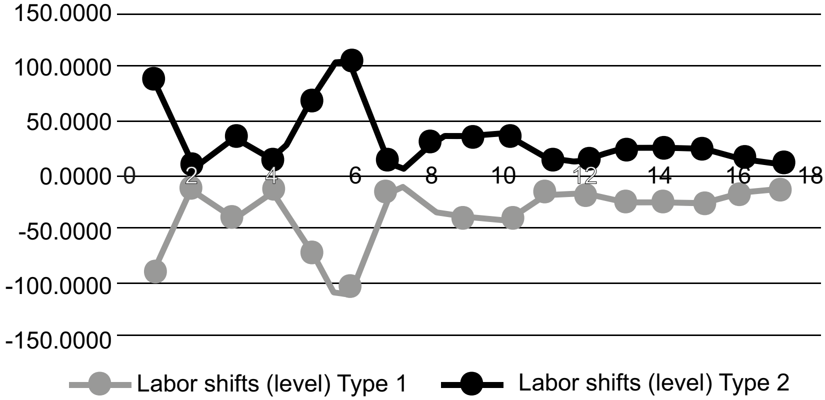


Figure 2 illustrates that the graph is perfectly symmetric, as implied by the model's assumptions. The regions most affected by the change in minimum wage are those that previously had the highest wage floors, particlarly NCR and Region IV-A.

TABLE 3. Agriculture to non-agriculture labor movement

	Type 1	Type 2
Agriculture	-57.860	81.500
Non-agriculture	-44.701	86.314

In Table 3, the agricultural sector *i* observes that changes in the minimum wage have cause a substantial decrease in the Type 1 market, which has prompted a transfer to the Type 2 market. Similarly, the non-agricultural sectors also saw the same transfer from Type 1 to Type 2 with a greater movement of labor *vis-à-vis* the agricultural sector.

Table 4 provides a detailed breakdown of the resulting changes in production, consumer and producer prices, and labor demand. As expected, higher minimum wage reduces demand for Type 1 labor across regions, triggering the shift of workers into the Type 2 labor market. Contraction in production naturally follows this adjustment: with less laborers and no offsetting changes in labor productivity, output declines. We also observe significant increases in consumer prices and producer prices, particularly in the services sector, which registers the largest price gains across all regions.

TABLE 4. Regional consumer price changes and labor demand changes

Regions/sectors	Percentage change				
	Production	Prices		Labor demand	
		Consumer	Producer	Type 1	Type 2
NCR					
Agriculture	-6.3997	-8.1839	-15.5684	-37.4182	210.1348
Manufacturing	-6.9314	-4.6228	-7.3795	-28.6905	141.7148
Nonmanufacturing	-6.8689	-5.2168	-9.7257	-27.0424	112.3873
Services	-6.8243	-2.5630	-4.6526	-31.1812	181.9042
CAR					
Agriculture	-6.4961	-7.7139	-14.2312	-62.1172	111.9954
Manufacturing	-6.8260	-5.1818	-8.2357	-50.3172	84.7652
Nonmanufacturing	-7.6055	0.1288	0.2928	-47.7552	64.9449
Services	-9.6457	14.8543	26.5556	-55.9977	100.6185
Ilocos Region					
Agriculture	-7.2996	-3.6820	-6.4242	-60.4828	149.9017
Manufacturing	-8.6996	5.3641	8.9410	-50.7376	101.1068
Nonmanufacturing	-7.4179	-1.2646	-2.2550	-46.1788	84.3735
Services	-10.0673	17.7635	30.0745	-55.0564	128.2151
Cagayan Valley					
Agriculture	-7.0305	-5.0555	-9.5352	-57.0939	73.2866
Manufacturing	-11.3790	22.9847	38.6129	-49.1700	47.4028
Nonmanufacturing	-7.3444	-1.8045	-3.5839	-43.3459	43.8692
Services	-9.7906	15.8443	26.4215	-51.5642	65.6829
Central Luzon					
Agriculture	-6.6374	-7.0200	-11.9060	-52.8274	113.3408
Manufacturing	-7.1081	-3.6773	-5.8401	-42.2547	82.5488
Nonmanufacturing	-7.2813	-2.2656	-4.1379	-39.7042	65.1308
Services	-9.1012	11.2218	19.4989	-47.1746	99.6386
CALABARZON					
Agriculture	-5.8781	-10.6778	-17.3749	-50.7013	143.0772
Manufacturing	-7.0161	-4.1709	-6.3123	-39.7738	103.3609
Nonmanufacturing	-7.0590	-3.8693	-7.2295	-37.7445	80.6220
Services	-8.9752	10.4014	17.5503	-44.8244	125.0133
MIMAROPA					
Agriculture	-6.6954	-6.7332	-13.2657	-62.1551	65.7989
Manufacturing	-7.4784	-1.6592	-2.5293	-52.4578	46.6927
Nonmanufacturing	-6.8902	-5.0671	-8.3881	-47.7412	40.1137
Services	-10.7392	22.5828	37.5106	-56.7652	58.8796

TABLE 4. Regional consumer price changes (continued)

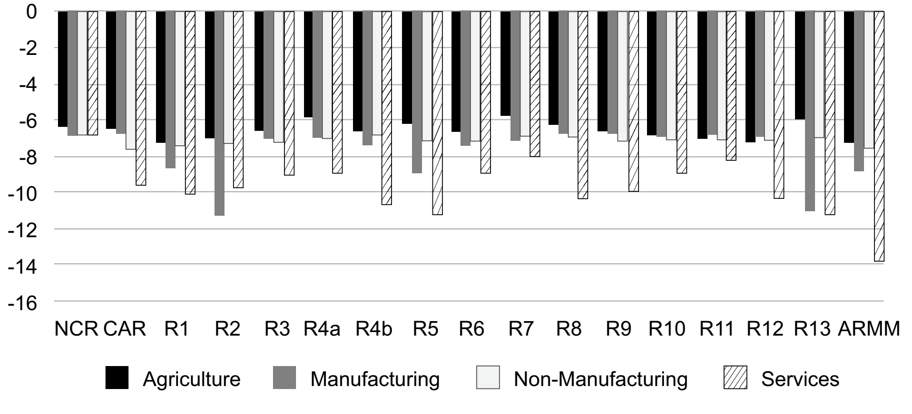
Regions/sectors	Percentage change				
	Production	Prices		Labor demand	
		Consumer	Producer	Type 1	Type 2
Bicol					
Agriculture	-6.3026	-8.6545	-17.0648	-63.3603	77.8571
Manufacturing	-8.9939	7.1447	11.3942	-54.2435	52.6711
Nonmanufacturing	-7.1802	-2.9989	-5.8979	-49.3321	45.4767
Services	-11.2744	26.5905	45.8460	-58.2268	68.0262
Western Visayas					
Agriculture	-6.7483	-6.4709	-12.8807	-54.3601	85.2702
Manufacturing	-7.4896	-1.5972	-2.3775	-44.5209	61.5116
Nonmanufacturing	-7.2527	-2.4733	-4.6259	-40.9747	50.4020
Services	-9.1576	11.5919	19.7915	-48.6008	76.6111
Central Visayas					
Agriculture	-5.8294	-10.9064	-21.6438	-54.3169	67.4801
Manufacturing	-7.1961	-3.2022	-4.9187	-44.0403	50.7292
Nonmanufacturing	-6.9723	-4.4867	-8.4576	-41.1997	39.9751
Services	-8.0331	4.4853	8.1852	-48.1085	62.9935
Eastern Visayas					
Agriculture	-6.3877	-8.2421	-15.8971	-61.6420	53.5231
Manufacturing	-6.7950	-5.3455	-7.7180	-51.3418	40.1345
Nonmanufacturing	-7.0360	-4.0333	-7.4630	-47.1474	33.4075
Services	-10.4128	20.2134	34.8230	-56.2140	48.5885
Zamboanga					
Agriculture	-6.6906	-6.7568	-13.8415	-62.7470	62.0811
Manufacturing	-6.8194	-5.2165	-7.6031	-51.9692	47.4209
Nonmanufacturing	-7.1496	-3.2193	-5.7470	-48.5083	37.4215
Services	-9.9239	16.7646	29.5675	-56.8442	57.6264
Northern Mindanao					
Agriculture	-6.8915	-5.7559	-11.0229	-57.4839	67.0955
Manufacturing	-7.0009	-4.2521	-6.2808	-46.6426	51.5490
Nonmanufacturing	-7.1675	-3.0900	-6.1153	-43.4571	40.9981
Services	-8.9312	10.1161	18.4464	-51.4208	62.2312
Davao Region					
Agriculture	-7.0848	-4.7803	-12.0096	-57.3213	69.5163
Manufacturing	-6.8908	-4.8387	-6.9692	-46.6805	52.6667
Nonmanufacturing	-7.1438	-3.2612	-6.2125	-43.6591	41.4891
Services	-8.2887	6.0524	10.8251	-50.9926	65.1919

TABLE 4. Regional consumer price changes (continued)

Regions/sectors	Percentage change				
	Production	Prices		Labor demand	
		Consumer	Producer	Type 1	Type 2
SOCCSKSARGEN					
Agriculture	-7.2980	-3.6904	-7.5205	-60.6217	71.2685
Manufacturing	-6.9605	-4.4678	-6.3860	-50.1967	52.8205
Nonmanufacturing	-7.1508	-3.2107	-5.8597	-46.3646	43.1093
Services	-10.4205	20.2681	35.2351	-55.2520	63.3915
CARAGA Region					
Agriculture	-6.0286	-9.9662	-19.2643	-61.3722	71.5484
Manufacturing	-11.0756	20.8211	30.5685	-53.1102	46.1896
Nonmanufacturing	-7.0267	-4.0996	-5.2289	-47.1069	43.1093
Services	-11.2643	26.5132	46.9775	-56.5191	61.7121
ARMM					
Agriculture	-7.3160	-3.5977	-7.6757	-64.3665	41.0086
Manufacturing	-8.8736	6.4125	10.6069	-55.0650	28.2956
Nonmanufacturing	-7.5839	-0.0327	-0.0609	-49.9517	25.3751
Services	-13.8258	47.9703	88.5442	-60.6553	32.1878

Figure 3 illustrates losses experienced in all regions due to the minimum wage increase. As shown, in the absence of productivity improvement among affected laborers, raising the minimum wage would lead to great adverse effect on output. This result is unsurprising given that the the proposed national minimum wage is a sizable hike, around 1.2 to 1.7 times greater for most regions of the Philippines and higher compared to NCR, which historically has had the highest minimum wage.

FIGURE 3. Regional production effects for Simulation 1



The production of all sectors across regions declines substantially compared to pre-minimum wage levels. The sharpest reductions occur in the services sector, which also has the largest increase in consumer and producer prices. Notably, the highest price increases are observed for the services sector in ARMM, resulting in a disproportionately large decline in production *vis-à-vis* other regions.

Table 5 presents inflation rates and changes in the labor income for each region following a minimum wage hike. Real incomes for Type 1 laborers mostly increase in some regions. By contrast, the real incomes of Type 2 laborers decrease significantly due to the surplus in laborers. With the increase in minimum wage across the board, total incomes for the region drop significantly and regional inflation is at an all-time high.

TABLE 5. Regional real effects and inflation

	Real effects (nominal less inflation), percent change from base					Regional Inflation
	Labor income			Inflation income	Total income	
	Type 1	Type 2	Total labor			
NCR	4.1686	-23.5985	1.1415	-6.0935	-5.2062	-2.9805
CAR	7.3530	-18.3404	0.7034	-14.0946	-10.4684	3.2120
Ilocos Region	0.9413	-25.4115	-4.5356	-19.5379	-14.2077	7.9744
Cagayan Valley	-0.1360	-17.5755	-5.9159	-16.0531	-11.8568	5.3425
Central Luzon	3.5511	-20.8782	-2.5987	-12.4151	-9.4185	2.0748
CALABARZON	5.1088	-21.2693	0.0945	-10.9267	-8.3592	0.4522
MIMAROPA	1.5616	-18.7131	-6.2015	-17.5706	-13.0644	6.0093
Bicol	-3.6323	-26.5961	-12.1222	-23.8678	-17.3441	11.6701
Western Visayas	1.1272	-19.2238	-4.5870	-15.1754	-11.1086	4.4005
Central Visayas	7.0500	-14.9485	0.0580	-10.9525	-8.1349	0.5232
Eastern Visayas	3.5006	-16.8696	-4.6522	-15.7306	-11.7971	4.6099
Zamboanga	4.9557	-17.0554	-3.3518	-14.8930	-11.1959	4.1653
Northern Mindanao	5.7852	-14.5355	-0.8258	-12.0839	-9.0636	1.7117
Davao Region	6.8100	-14.5871	-0.4115	-11.2714	-8.4479	0.9352
SOCCSKARGEN	1.6302	-17.5275	-4.4404	-16.1029	-12.2206	5.2879
CARAGA Region	-2.5942	-24.5713	-11.0609	-22.4103	-16.4070	10.3000
ARMM	-9.6742	-23.9884	-16.5789	-22.3496	-18.5659	13.0715

Table 6 shows that once the region results have been aggregated, total real income (GDP) would decline by roughly 8.31 percent, while nominal GDP would fall by 7.61 percent. Type 2 labor market would experience wage reductions across all regions as the increased supply, caused by the increase in minimum wage for the Type 1 labor market, pushes wages downward.

TABLE 6. Economy wide effects in Simulation 1

	Percent change	
	Nominal	**Real**
Type 1 Labor income		
Agriculture	-5.91986	-6.62313
Manufacturing	12.04136	11.33808
Non-Manufacturing	19.29683	18.59356
Services	4.59775	3.89448
Type 2 Labor income		
Agriculture	-23.98841	-11.25447
Manufacturing	-30.13071	-24.69169
Non-Manufacturing	-16.50710	-30.83398
Services	0.00000	-17.21037
Other (Capital) income		
Agriculture	-10.28885	-8.31840
Manufacturing	-11.75803	-10.99212
Non-Manufacturing	-9.80944	-12.46131
Services	0.00000	-10.51271
Total income (GDP)	-7.60727	-8.31054

3.2. Simulation 2

Simulation 2 modifies Simulation 1 by introducing increases in labor factor productivity. Given that Type 1 labor market wages rise to ₱750 for all regions, it is reasonable to expect corresponding increases in productivity. For this exercise, we apply an increase of 20 percent for all Type 1 laborers. While different regions may realistically experience heterogeneous productivity responses, we impose a uniform rate for tractability. We also assume no labor productivity loss in the Type 2 labor market despite the decrease in wages. These assumptions are restrictive but useful in isolating comparative effects of productivity gains.

As shown in Table 7, production losses across the sectors and regions of the economy are smaller than in Simulation 1. The pattern of the consumer and producer price effects remain broadly similar with the services sector continuing to experience sharp price increases in regions which had a very low minimum wage prior to the adjustment to ₱750.

Relative to Simulation 1, the decline in real GDP improves from 8 percent to roughly 4.95 percent with a nominal value trending lower than 4.6 percent. This reduction in output loss is consistent with introducing productivity gains in the Type 1 labor market. However, these results do not account for productivity losses in the Type 2 labor market.

TABLE 7. Simulation 2 changes in production, prices, and labor demand

Regions/sectors	Percentage change				
	Production	Prices		Labor demand	
		Consumer	Producer	Type 1	Type 2
NCR					
Agriculture	-3.3748	-8.1656	-15.5335	-36.3308	218.1892
Manufacturing	-4.0986	-3.2788	-5.2340	-30.7272	146.7714
Nonmanufacturing	-4.0090	-4.1857	-7.8034	-30.1244	117.3409
Services	-4.0126	-1.9610	-3.5598	-31.8960	187.2150
CAR					
Agriculture	-3.3009	-8.5128	-15.7048	-61.2374	112.5615
Manufacturing	-4.1488	-3.0155	-4.7927	-51.8028	84.2906
Nonmanufacturing	-4.6246	0.1701	0.3868	-49.8277	66.0334
Services	-6.3460	11.8316	21.1519	-56.1834	100.5361
Ilocos Region					
Agriculture	-4.2654	-3.8542	-6.7245	-59.7391	150.0078
Manufacturing	-5.4126	3.9029	6.5055	-51.8223	102.5402
Nonmanufacturing	-4.5195	-0.5896	-1.0514	-48.4071	85.5116
Services	-6.6169	13.5778	22.9878	-55.1592	128.9813
Cagayan Valley					
Agriculture	-4.0357	-4.9891	-9.4101	-56.1705	73.1404
Manufacturing	-7.1338	14.2964	24.0171	-49.6639	49.8723
Nonmanufacturing	-4.4369	-1.1823	-2.3480	-45.6085	44.5998
Services	-6.3391	11.7876	19.6567	-51.6643	65.7027
Central Luzon					
Agriculture	-3.7935	-6.1682	-10.4614	-51.9052	113.5740
Manufacturing	-4.2929	-2.2553	-3.5817	-43.8411	82.8182
Nonmanufacturing	-4.2438	-2.5505	-4.6584	-42.0364	66.6170
Services	-5.6011	7.1920	12.4969	-47.2383	100.5175
CALABARZON					
Agriculture	-2.9184	-10.2848	-16.7354	-49.6841	144.4361
Manufacturing	-4.2455	-2.5058	-3.7923	-41.5189	103.8775
Nonmanufacturing	-4.1284	-3.3583	-6.2748	-40.2464	82.3775
Services	-5.4815	6.4684	10.9142	-44.9309	126.5219
MIMAROPA					
Agriculture	-3.6636	-6.7933	-13.3841	-61.2603	65.6913
Manufacturing	-4.4302	-1.5237	-2.3227	-53.4505	47.2580
Nonmanufacturing	-4.1619	-3.1248	-5.1728	-49.8705	40.5304
Services	-7.1887	17.3702	28.8525	-56.7724	58.9379

TABLE 7. Simulation 2 changes (continued)

Regions/sectors	Percentage change				
	Production	Prices		Labor demand	
		Consumer	Producer	Type 1	Type 2
Bicol					
Agriculture	-3.2646	-8.6826	-17.1202	-62.4806	77.4085
Manufacturing	-5.2566	3.0178	4.8127	-54.8630	54.1457
Nonmanufacturing	-4.2712	-2.3578	-4.6370	-51.2592	46.1036
Services	-7.5982	20.1794	34.7923	-58.1520	68.0861
Western Visayas					
Agriculture	-3.7773	-6.2463	-12.4337	-53.3787	85.4873
Manufacturing	-4.4824	-1.2443	-1.8522	-45.8498	62.1081
Nonmanufacturing	-4.3224	-1.9962	-3.7336	-43.3124	51.4234
Services	-5.7644	8.1892	13.9819	-48.7373	76.8449
Central Visayas					
Agriculture	-2.7730	-10.9475	-21.7254	-53.2046	68.5032
Manufacturing	-4.3577	-1.9110	-2.9354	-45.5082	51.1792
Nonmanufacturing	-4.1473	-3.2266	-6.0822	-43.5192	41.1503
Services	-4.9612	3.3879	6.1825	-48.4156	62.9823
Eastern Visayas					
Agriculture	-3.4411	-7.8526	-15.1459	-60.7154	53.5270
Manufacturing	-4.0996	-3.2735	-4.7262	-52.5548	40.1110
Nonmanufacturing	-4.2621	-2.4221	-4.4817	-49.2791	33.8770
Services	-6.8974	15.4199	26.5650	-56.2165	48.6818
Zamboanga					
Agriculture	-3.7631	-6.3148	-12.9360	-61.8806	62.1791
Manufacturing	-4.1330	-3.0984	-4.5159	-53.2312	47.3566
Nonmanufacturing	-4.2883	-2.2372	-3.9938	-50.5004	38.2761
Services	-6.5511	13.1506	23.1936	-56.9391	57.5900
Northern Mindanao					
Agriculture	-3.9995	-5.1661	-9.8934	-56.5720	67.4483
Manufacturing	-4.2589	-2.4349	-3.5967	-48.1119	51.6648
Nonmanufacturing	-4.3281	-1.9559	-3.8708	-45.7460	41.9204
Services	-5.6810	7.6786	14.0016	-51.6207	62.3499
Davao Region					
Agriculture	-4.0788	-4.7771	-12.0016	-56.3685	70.0573
Manufacturing	-4.1740	-2.8833	-4.1528	-48.1313	52.8606
Nonmanufacturing	-4.2679	-2.3810	-4.5358	-45.8731	42.6112
Services	-5.1992	4.7836	8.5558	-51.2779	65.0616

TABLE 7. Simulation 2 changes (continued)

Regions/sectors	Percentage change				
	Production	Prices		Labor demand	
		Consumer	Producer	Type 1	Type 2
SOCCSKSARGEN					
Agriculture	-4.3095	-3.6344	-7.4065	-59.7828	71.1760
Manufacturing	-4.2266	-2.6059	-3.7248	-51.5132	52.8186
Nonmanufacturing	-4.3361	-1.8992	-3.4661	-48.5502	43.7641
Services	-6.9051	15.4706	26.8950	-55.2971	63.6596
CARAGA Region					
Agriculture	-2.9199	-10.2778	-19.8665	-60.4104	71.2291
Manufacturing	-6.9043	12.8411	18.8526	-53.5464	48.2122
Nonmanufacturing	-4.2363	-2.6034	-3.3206	-49.2383	43.3682
Services	-7.5159	19.6089	34.7441	-56.4000	61.8934
ARMM					
Agriculture	-4.3688	-3.3378	-7.1213	-63.5249	40.3350
Manufacturing	-5.5204	4.5202	7.4769	-55.8269	28.9022
Nonmanufacturing	-4.6669	0.4774	0.8892	-51.8787	25.6962
Services	-9.6537	35.5456	65.6106	-60.2802	33.0364

TABLE 8. Simulation 2 economy-wide changes

	Percent change	
	Nominal	Real
Type 1 Labor income		
Agriculture	-3.87128	-4.23792
Manufacturing	8.99596	8.62932
Non-Manufacturing	14.49394	14.12729
Services	4.19244	3.82580
Type 2 Labor income		
Agriculture	-21.80114	-8.27825
Manufacturing	-27.83129	-22.16779
Non-Manufacturing	-14.18547	-28.19793
Services	0.00000	-14.55211
Other (Capital) income		
Agriculture	-6.24391	-4.64798
Manufacturing	-7.05714	-6.61055
Non-Manufacturing	-5.98880	-7.42378
Services	0.00000	-6.35545
Total income (GDP)	-4.59581	-4.96246

3.3. Simulation 3

In the third simulation, the national minimum wage is again set to ₱750 across all regions, but the productivity adjustment varies according to the amount of wage increase per region. Those regions experiencing larger wage hikes receive correspondingly larger productivity gains.

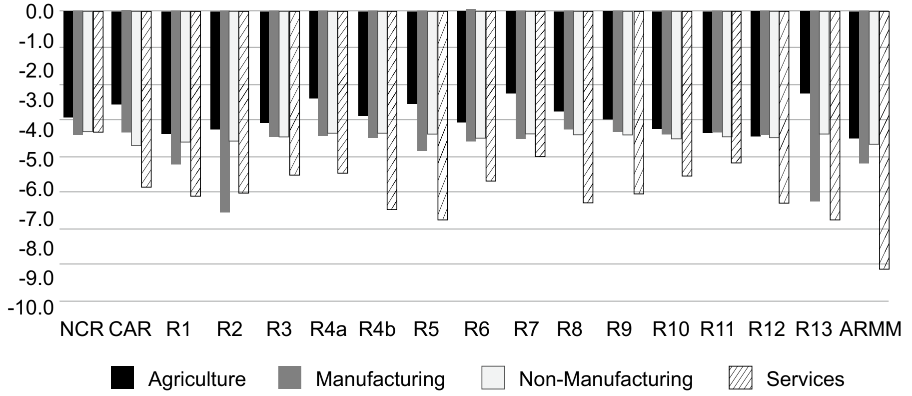
TABLE 9. Simulation 3 economy-wide changes

	Percent change	
	Nominal	**Real**
Type 1 Labor income		
Agriculture	-4.10736	-4.42304
Manufacturing	9.62597	9.310285
Non-Manufacturing	14.45193	14.13624
Services	4.317833	4.002149
Type 2 Labor income		
Agriculture	-21.7084	-8.33301
Manufacturing	-27.8017	-22.0241
Non-Manufacturing	-14.0925	-28.1174
Services	0	-14.4082
Other (Capital) income		
Agriculture	-6.2829	-4.58603
Manufacturing	-7.08057	-6.59858
Non-Manufacturing	-6.04749	-7.39626
Services	0	-6.36317
Total income (GDP)	-4.60543	-4.92111

As seen in Table 9, GDP still declines, with results very similar to Simulation 2. This outcome reflects offsetting dynamics across regions: while areas with substantial increases experience productivity boosts, major production contributors like NCR and CARAGA receive smaller adjustments due to relatively modest wage adjustments.

Figure 4 shows the resulting regional production outcomes. Patterns mirror earlier simulation, with the largest production decline observed in regions with higher minimum wage increases and the services sector being the most affected. The manufacturing sector has also been more adversely affected relative to the non-manufacturing sector in most regions.

FIGURE 4. Regional production effects for Simulation 3



3.4. Simulation 4

The fourth and final simulation sets the national minimum wage equal to the minimum wage in the National Capital Region and assumes a 10 percent added labor productivity increase for all regions except NCR.

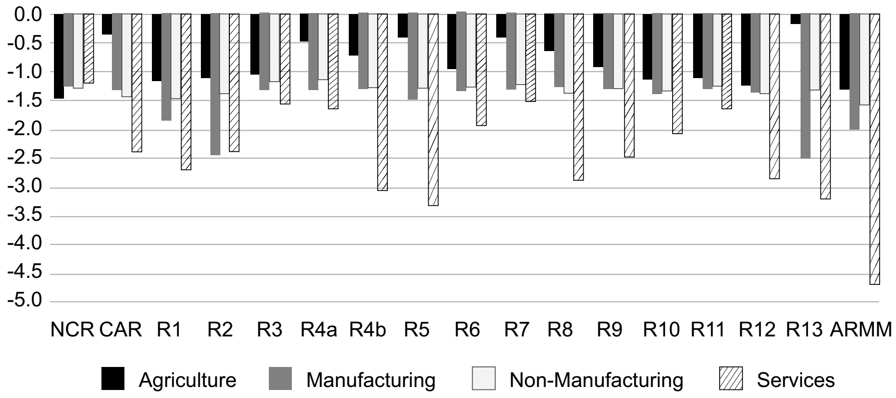
As shown in Table 10, the GDP is likely to decrease when aggregated at the national level. However, this decrease is much less compared to the declines observed in the previous three simulations.

TABLE 10. Simulation 4 economy wide changes

	Percent change	
	Nominal	**Real**
Type 1 labor income		
Agriculture	-1.39739	-1.44812
Manufacturing	3.15166	3.10093
Non-Manufacturing	6.13015	6.07942
Services	2.15194	2.10121
Type 2 labor income		
Agriculture	-10.80111	-3.78011
Manufacturing	-14.36915	-10.85184
Non-Manufacturing	-6.35612	-14.41988
Services	0.00000	-6.40685
Other (capital) income		
Agriculture	-1.92038	-1.10491
Manufacturing	-2.13545	-1.97111
Non-Manufacturing	-1.88214	-2.18618
Services	0.00000	-1.93287
Total income (GDP)	-1.41390	-1.46463

Figure 5 summarizes regional production effects. Production declines across all regions, but the magnitude of these declines is much less compared to the previous three simulations.

FIGURE 5. Regional production effects for Simulation 4



Overall, results suggest that large increases in minimum wage have adverse effects on the productivity of the economy even in the presence of realistic productivity gains brought about by the increase in minimum wage. Although adjusting all regional wages to NCR's level represents a smaller shock than imposing a uniform ₱750 wage, it still constitutes a drastic increase for many regions. Moreover it is unrealistic to assume larger productivity gains than those in Simulation 2, given the smaller size of the wage adjustment in this scenario.

3.5. Poverty microsimulations

Using the 2012 Labor Force Survey, we compute poverty effects through a microsimulation framework. The analysis examines changes in the Gini coefficient and levels of poverty incidence, poverty gap, and poverty severity. For this purpose, we take the simulations presented in Simulation 1 and Simulation 4 to assess how minimum wage adjustments translate into distributional and poverty outcomes.

As shown in Table 11, Simulation 4 was able to induce more positive impacts, based on poverty indicators, relative to Simulation 1. Both simulations reduce poverty indicators within the formal sector, which is to be expected given the rise in wages. However, the magnitude of these improvements is smaller than one might anticipate from such substantial wage increases. This could potentially be due to the scope of the formal labor market captured in this model, which does not not represent all economy-wide channels through which minimum wage policies operate. Additionally, the model is entirely static and, therefore, cannot account for dynamic adjustments or long-term poverty impacts.

TABLE 11. Poverty microsimulations

		Base 2012	Simulation 1		Simulation 4	
		Level	Level	Percent change from base	Level	Percent change from base
GINI Coefficient		0.47126	0.47110	-0.034	0.47107	-0.039
Philippines	Poverty Incidence	24.848	24.755	-0.375	24.754	-0.379
	Poverty Gap	6.836	6.805	-0.457	6.804	-0.464
	Poverty Severity	2.679	2.665	-0.519	2.664	-0.536
Urban	Poverty Incidence	11.570	11.507	-0.550	11.506	-0.556
	Poverty Gap	2.794	2.781	-0.440	2.781	-0.446
	Poverty Severity	0.989	0.986	-0.377	0.986	-0.364
Rural	Poverty Incidence	35.584	35.467	-0.329	35.466	-0.332
	Poverty Gap	10.105	10.058	-0.460	10.057	-0.468
	Poverty Severity	4.044	4.022	-0.546	4.021	-0.570

Figure 6 and Figure 7 summarize these results across regions for each poverty indicator. The two simulations yield broadly similar results, with most regions experiencing declines in poverty indicators. Region II exhibits slight increases while all other regions have declined as expected.

FIGURE 6. Poverty microsimulation for Simulation 1

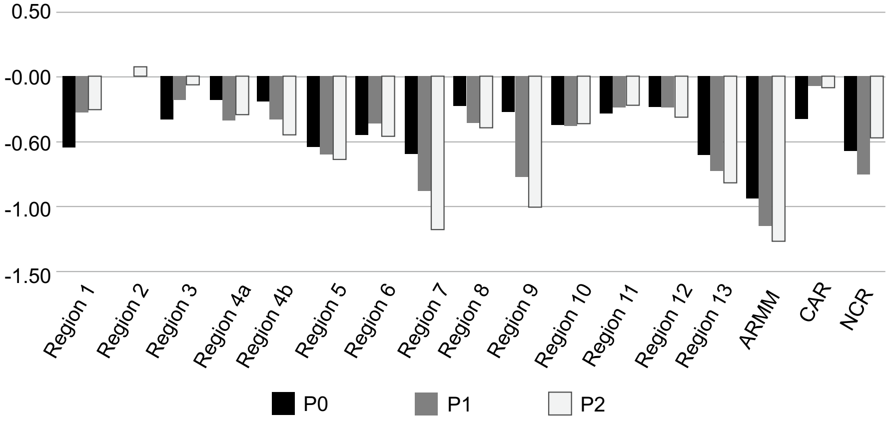
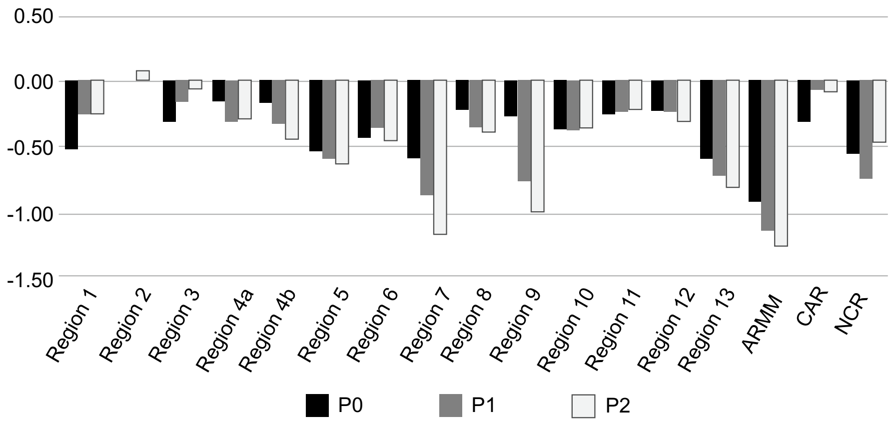


FIGURE 7. Poverty microsimulation for Simulation 4



4. Conclusion and policy recommendations

The simulation results provide compelling evidence that implementing a uniform national minimum wage in the Philippines, particularly at the ₱750 level proposed under HB 7787, would trigger severe economic disruptions whose costs substantially outweigh potential benefits. The findings reveal fundamental trade-offs between improving wage adequacy and employment sustainability. These require nuanced policy responses rather than dramatic uniform adjustments.

The most striking finding is the magnitude of economic contraction under the proposed ₱750 national minimum wage. Under Simulation 1, with no productivity adjustments, real GDP declines by 8.31 percent, driven by production losses of 5.8 to 13.8 percent across regions. These declines stem from massive formal sector employment losses, with Type 1 labor demand falling from 37.4 percent in NCR to 64.4 percent in ARMM. The resulting displacement of 44,701 workers in NCR and up to 101,824 in CALABARZON puts severe pressure on informal labor markets.

The influx of displaced workers suppresses Type 2 wages down by 35.6 to 72.1 percent. Even under optimistic assumptions of 20 percent productivity gains (Simulation 2), real GDP still contracts by 4.96 percent, indicating that the magnitude of the wage shock overwhelms plausible productivity adjustments, consistent with international evidence showing that productivity-wage elasticities rarely exceed 0.3 to 0.4 [Manning 2021]. The proportional productivity scenario (Simulation 3) yields nearly identical results, indicating that regional variation in productivity responses provides minimal cushioning and cannot neutralize a macroeconomic shock.

Regional heterogeneity further compounds concerns. Inflation ranges from -2.98 percent in NCR to 13.07 percent in ARMM, with services sector producer prices increasing 88.5 percent in the latter. These extreme variations reflect pre-existing wage disparities—ARMM's minimum wage must increase 167 percent to reach ₱750,compared to 46 percent in NCR. Rather than equalizing living standards, the reform would widen regional inequalities and impose disproportionate burdens on poorer regions.

Most concerning, however, is the minimal poverty reduction despite the substantial wage increase. Poverty incidence declines by only 0.375 to 0.379 percent, and the Gini coefficient improves marginally from 0.47126 to 0.47107. These modest gains occur because informal sector workers, who comprise significant portions of poor households, experience real income declines of 14 to 31 percent due to increased labor supply from displaced formal workers. This finding aligns with the observation that minimum wage policies in economies with large informal sectors often fail to reach intended beneficiaries [Fields 2019].

4.1. Policy recommendations

Based on the simulation results and international evidence, we recommend a comprehensive reform strategy that balances wage adequacy with employment sustainability.

4.1.1 Graduated regional approach

A uniform national wage is not advisable given the country's structural regional heterogeneity. Instead, policymakers should adopt a graduated regional convergence strategy based on regional economic capacity.

Simulation 4 suggests that setting wages at NCR levels (approximately ₱515) with modest 10 percent productivity support limits GDP decline to 1.46 percent. This could serve as a transitional benchmark, with convergence occurring gradually over five to seven years, similar to Germany's decades-long path to national minimum wage harmonization [Caliendo et al. 2018].

4.1.2. Productivity enhancement programs

Any wage increase must be coupled with strong productivity support interventions. Priority areas include: (1) skills training programs targeting displaced formal sector workers, (2) technology adoption subsidies for small and medium enterprises (SMEs) facing wage pressures, (3) infrastructure investments in lagging regions to reduce business costs, and (4) streamlined regulations to offset increased labor costs. Evidence from successful minimum wage implementations shows productivity programs can generate 15 to 25 percent efficiency gains over three to five years, partially validating our simulation assumptions.

4.1.3. Strengthen regional wage boards

Rather than abolishing RTWPBs as proposed, their institutional capacities should be enhanced through (1) mandatory inflation indexation to protect real wage value, (2) shortened review cycles from annual to semi-annual during high inflation periods, (3) expanded representation, including informal sector workers, and (4) technical secretariats with economic modeling capabilities. The failure to keep wages aligned with post-TRAIN inflation reflects institutional weaknesses, not inherent flaws in regional wage-setting frameworks.

4.1.4. Complementary social protection

Reducing working poverty requires integrated interventions beyond wages. Key measures include expanding the Pantawid Pamilyang Pilipino Program (4Ps) coverage to include working poor households. In addition, implementing earned income tax credits for low-wage formal sector workers, subsidizing social insurance contributions to encourage formalization, and strengthening labor inspection to ensure compliance with existing wages are also key social protection additions that may benefit long term.

4.2. Study limitations and future research

Several limitations warrant acknowledgment. The static CGE model cannot capture dynamic adjustments including capital-labor substitution, technological change, or long-run growth effects. The 2012 FIES data may not fully represent current household structures, particularly post-COVID changes in employment patterns. Additionally, the model does not capture potential benefits from increased consumer spending or reduced worker turnover. Future research should incorporate dynamic CGE models with forward-looking behavior, updated post-pandemic household surveys to examine pandemic-induced structural changes, and quasi-experimental evaluation of the 2025 wage adjustments. Cross-country comparative analysis with other ASEAN economies implementing wage reforms would provide valuable regional perspectives.

4.3. Final remarks

Minimum wages are a vital yet blunt policy instrument for addressing working poverty. The results of this study demonstrate that dramatic increases risk severe unintended consequences, particularly for vulnerable informal workers. The Philippine experience with TRAIN law further illustrates how well-intentioned policies can produce regressive outcomes without careful design and implementation. Success requires acknowledging that sustainable wage increases must reflect and promote productivity growth, not precede it. International evidence consistently shows that gradual, differentiated approaches coupled with complementary policies achieve better outcomes than dramatic uniform changes. As the Philippines navigates post-pandemic recovery amid global inflation, policy makers must resist political pressures for quick fixes and instead pursue evidence-based reforms that genuinely improve worker welfare without destroying the jobs they depend upon. The path forward demands not choosing between adequate wages and employment but rather crafting policies that promote both through patient institution-building, targeted interventions, and continuous adaptation based on rigorous evaluation. Only through such comprehensive approaches can minimum wage policy fulfill its promise of reducing poverty while supporting inclusive economic growth.

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Decomposing the divergent post-pandemic productivity dynamics in Philippine manufacturing

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This paper draws on the 2019 to 2022 Annual Survey of Philippine Business and Industry to document new stylized facts on the post-pandemic dynamics of total factor productivity (TFP) in Philippine manufacturing. The estimates confirm the severe but heterogeneous productivity impact of Coronavirus disease 2019 (COVID-19) across sectors and regions, with low-tech industries suffering steep TFP declines. Recovery patterns were uneven: large manufacturers rebounded quickly after significant 2020 losses, medium-sized firms showed surprising resilience, while small firms struggled to regain their pre-pandemic productivity. Fixed-effects regressions show the significant and positive relationship of total hours worked, human capital, and tangible investment with TFP. In contrast, the productivity premia from research and development spending, financial access, and intangible investment are not robust after controlling for selection bias. This suggests that highly productive manufacturers compensated their reduced production capacity primarily through efficient labor utilization, skilled manpower, and capital deepening, which enabled agile business adjustments amidst pandemic shocks. Decomposition analysis also reveals the widening TFP gap between small and medium-sized firms, which accelerated between 2020 and 2022 due to increasing differences in endowment and persistent underlying traits. These findings underscore the constraints facing small manufacturers and the growing marginalization of their contribution to post-pandemic productivity growth.

JEL classification: D22, D24, L60
Keywords: Philippines, manufacturing, COVID-19 pandemic, total factor productivity, SMEs, Kitagawa–Oaxaca–Blinder decomposition

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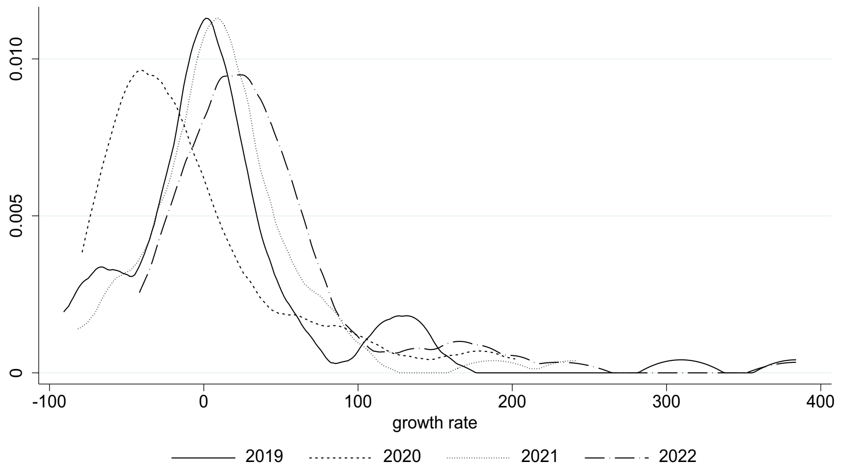
1. Introduction

Philippine manufacturing was adversely affected by Coronavirus disease 2019 (COVID-19) shocks, with real revenues (in 2018 prices) dropping by 14.23 percent in 2020. This was accompanied by similar sharp declines in the number of manufacturing establishments (-7.45 percent), employment (-13.18 percent), and labor productivity (-7.57 percent). Notwithstanding, manufacturing exhibited a strong post-pandemic rebound, with real revenues growing by 6.46 percent in 2021 and 19.26 percent in 2022. This is corroborated by Figure 1, which shows the kernel densities of the growth of real revenues of manufacturing subsectors at the three-digit level of the Philippine Standard Industry Classification (PSIC). The distribution first shifted to the left from 2019 to 2020 but quickly shifted back to the right from 2020 to 2021 and 2022. This indicates that many sectors have recovered from the temporary but adverse economic impacts of COVID-19 shocks. The Philippines implemented one of the longest and most stringent lockdowns during the pandemic, which generated simultaneous demand and supply disturbances that disrupted the productive activities of households and firms [Mendoza 2021].

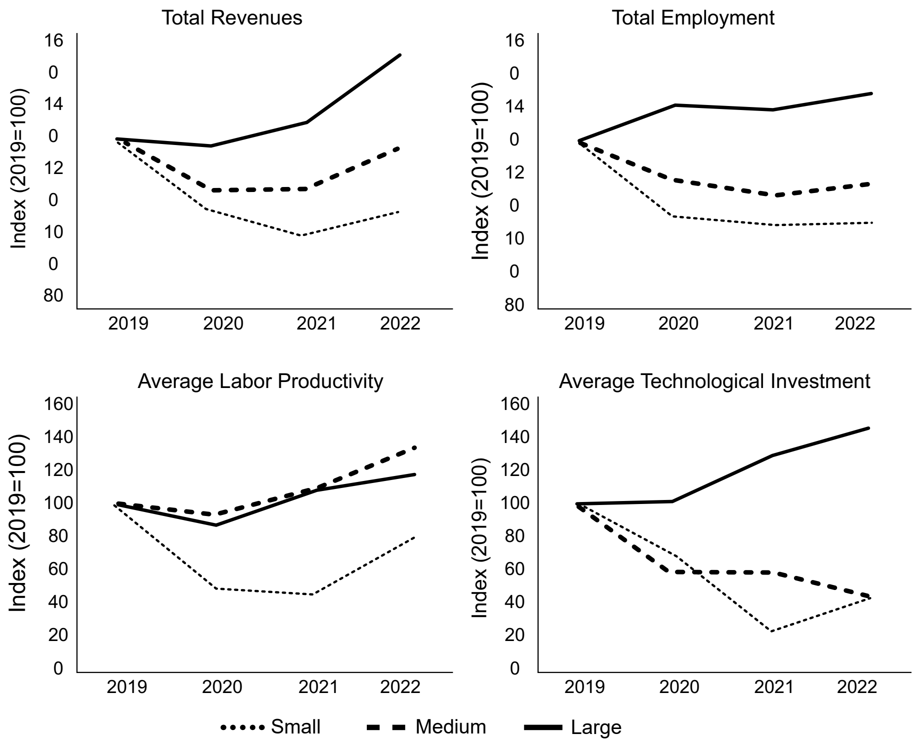
FIGURE 1. Kernel densities of manufacturing revenue growth rates of three-digit PSIC sectors, 2019-2022



Source of raw data: Philippine Statistics Authority (PSA).
Growth rates above 500 were excluded to remove extreme values.

Disaggregation of aggregate trends, however, shows a divergent post-pandemic performance of small and medium-sized establishments (SMEs) versus large manufacturers. As suggested by Figure 2, the strong manufacturing rebound in 2021 and 2022 was mainly driven by large establishments, while SMEs only sustained slow and weak recovery. The World Bank [2022] observed that Philippine establishments were operating in 2022 with fewer workers than before the pandemic, indicating a possible labor market scarring. The negative implications are not trivial, given that the share of SMEs in total manufacturing employment shrank from 54 percent in 2019 to just 34 percent in 2022. This translates to more than 321,000 unrecovered SME-related jobs after the pandemic, possibly resulting in severe income shocks and welfare losses in low-income households. Figure 2 also shows that the technological investment of SMEs stalled after 2020. This suggests that the scarring effect of the pandemic in the Philippines, if it exists, could partly be traced to the weak recovery of SMEs.

FIGURE 2. Indices of Philippine manufacturing indicators by size (2019 = 100)



Source of raw data: PSA.
Technological investment refers to the sum of capital expenditures on machinery and equipment, computer software and databases, and research and development (R&D).

Earlier documentations of the pandemic experience of Philippine establishments, particularly microenterprises, suggest that many businesses endured more than 50 percent revenue loss due to difficulties in input sourcing and supply chain coordination, liquidity constraints, and shortages of workers, which led to drastic cuts in operating hours (ADB [2020]; UNIDO [2020]; World Bank [2020]; Shinozaki and Rao [2021]). Most establishments (especially SMEs) closed temporarily, while many of those that remained open operated only at half capacity or less [ADB 2020]. These can be traced to the lockdown-induced economic hibernation enforced by the government to contain the pandemic. Dampened demand from consumers further deteriorated sales and cash flows. These supply and demand shocks were aggravated by the fact that many firms lacked business continuity plans to cope with an extraordinary crisis like COVID-19 [UNIDO 2020]. Nevertheless, some establishments responded innovatively to the disruptions by resorting to digital solutions (e.g., shifting to a work-from-home setup, e-commerce, and online payment methods) to overcome mobility restrictions caused by stringent containment policies [World Bank 2020]. The combination of firms' innovative responses and less strict community quarantine measures led to more businesses reopening by the end of 2020, albeit only partially [World Bank 2021]. Nevertheless, the lingering shocks caused by lockdowns continued to drag sales as establishments were forced to operate below full capacity in the face of limited mobility of suppliers, employees, and consumers. Uneven access to financing and government support further slowed down the recovery of firms. These difficulties disproportionately hit SMEs, many of which voluntarily closed at the height of the lockdowns and eventually exited the market permanently. By the end of 2020, manufacturing alone shed 2,146 SMEs—a 9 percent decline from 2019.

The adverse impact of COVID-19 on establishments has broad empirical support from recent cross-country, firm-level studies. For instance, Muzi et al. [2023] showed that less productive firms, especially SMEs, permanently exited the market during the crisis—evidence of a Schumpeterian cleansing effect. In their study of firms in 23 Southern and Eastern European countries, Janzen and Radulescu [2022] also found that small businesses endured bigger cuts in year-on-year sales growth due to lockdown stringency. Amin et al. [2025] attributed this to SMEs' larger vulnerabilities to supply, productivity, and financial shocks compared to large firms. Other studies suggest that SMEs with pre-pandemic innovative activities, better access to finance, crisis experience, and good institutional networks were less vulnerable to sales decline and market exit during the lockdowns (Chit et al. [2022]; Khan [2022]). Nevertheless, Doruk [2022] suggests that government assistance during the lockdowns helped firms, especially SMEs, weather the pandemic. On a macro level, Liu et al. [2021] found that survival is more likely for firms in countries with higher GDP per capita, less severe COVID-19 contagion, less stringent lockdowns, and a culture of future orientation.

The evidence from past global crises also suggests that smaller firms are less resilient to adverse economic shocks. For instance, Chen and Lee [2023] documented a divergence in the TFP growth of European SMEs and large firms after the Global Financial Crisis (GFC). The gap is partly traced to SMEs' exposure to more severe credit supply shocks and relatively larger reductions in intangible capital compared to large firms. Fort et al. [2013] added nuance to the crisis experience of small firms, observing that the decline in employment and market entry is more pro-cyclical among young small firms, while their older counterparts adjusted via layoffs rather than exit. Siemer [2019] showed that financial constraints during the GFC cut employment growth in US small firms by four to eight percentage points compared to large firms. This was mainly driven by constrained access to finance that heightened exit rates and suppressed entry of small and young enterprises. Chodorow-Reich [2013] found that US firms, especially SMEs, with pre-GFC ties to weak lending institutions experienced sharper employment cuts relative to establishments connected to healthier banks. Duval, Hong, and Timmer [2019] also observed from cross-country, firm-level data that establishments with fragile financial conditions before the GFC cut back on innovation spending during the crisis, which eventually weakened productivity growth.

The objective of this study is twofold. First, the paper generates updated estimates of production function parameters and TFP to provide stylized facts about the post-pandemic productivity trends in Philippine manufacturing. Second, the study formally analyzes the significant drivers of manufacturing productivity dynamics, especially among SMEs. This paper adds to the still limited literature that assesses the post-pandemic recovery of firms worldwide. Motivated by new establishment-level data released by the Philippine Statistics Authority (PSA) from 2019 to 2022, the current study investigates the seemingly two-speed recovery of establishments suggested by Figure 2. While the divergence between SMEs and large firms is not unexpected, the paper looks closer at the drivers of the deviant experiences of small and medium-sized manufacturers and identifies relevant strategies that smaller firms can adopt in order to catch up.

To our knowledge, this is the first documentation of the post-pandemic productivity dynamics of Philippine firms using official data, and among the very few micro-level studies that explore the topic in a developing-country setting. This paper also provides a descriptive analysis of updated estimates of production function parameters and TFP for Philippine manufacturing which are rarely available in the literature. The regressions show that efficient labor utilization, skilled manpower, experience, and tangible investment have robust positive and significant relationships with productivity. Focusing only on SMEs, the empirical analysis indicates a divergence in the productivity of small and medium-sized firms, which further widened between 2020 and 2022. This gap was traced to differences in endowment and persistent underlying traits, which dictated how well SMEs were able to ride the shockwaves generated by COVID-19 disruptions. These findings inform policy on designing post-crisis recovery programs for SMEs and for a robust manufacturing growth.

The rest of the paper proceeds as follows. Section 2 describes the data and methodology used in this study. Section 3 presents some stylized facts about the post-pandemic trends of TFP in Philippine manufacturing. Section 4 presents the results of the econometric analyses. Section 5 summarizes the paper and provides some policy insights.

2. Data and methodology

This section begins with a description of a newly assembled firm-level dataset used in the study. Section 2.2 sketches the control function approach for obtaining consistent estimates of production function parameters and TFP. Section 2.3 describes the econometric models used to analyze the key drivers of TFP and the decomposition technique for breaking down the post-pandemic productivity gap between groups of manufacturers.

2.1. Data

This study utilizes data from the Annual Survey of Philippine Business and Industry (ASPBI) from 2019 to 2022. The ASPBI covers 18 different sections classified based on the 2009 PSIC, although the current study focuses only on Section C (Manufacturing). The ASPBI is a nationally-representative survey that covers establishments in the formal sector of the economy. This excludes single proprietorship and single-establishment organizations with less than 10 employees. The sampling frame of the ASPBI was derived from the most recent List of Establishments, as summarized in Table 1. The ASPBI uses a stratified systematic sampling design with PSIC as the first stratification variable and employment size (i.e., micro, small, medium, and large), as the second stratification variable. This design reduces sampling bias and ensures that all important subgroups of the population of establishments are well-represented in the final sample. The region is the geographic domain of the ASPBI, which means that the survey can generate reliable estimates at this level.

TABLE 1. Number of establishments, 2019 to 2022

Year	List of establishments	ASPBI sampling frame	Estimated number of manufacturers
2019	1,000,524	336,712	24,270
2020	1,000,440	336,205	22,083
2021	1,079,093	349,071	25,279
2022	1,100,781	360,637	23,571

Source: PSA.

To form a panel dataset from 2019 to 2022, manufacturers across years were linked using their unique Enterprise Control Number (ECN). This longitudinal establishment dataset was then combined with the trade dataset to form the Merged Trade Transactions and Industry Censuses and Surveys (METTRICS) dataset. METTRICS enriches analysis by adding information on establishments' trading activities (e.g., monthly volume and value of imports and exports, destination of exports, origin of imports, and types of traded products based on the Philippine Standard Commodity Classification). For the 2019 to 2022 period, the METTRICS dataset for manufacturing contains 16,553 observations, 65.78 percent of which are small, 15.44 percent medium-sized, and 18.78 percent large. However, the panel is highly unbalanced, with only 1,030 establishments appearing in all years. Another limitation of the dataset is the absence of information on whether firms that do not appear in a given survey year have already exited the market or were merely excluded from the sample. The description and summary statistics of the variables used in this study are in Appendices 1 and 2, respectively.

2.2. Estimating total factor productivity

TFP measures how efficiently a firm can increase output using the same amount of labor and capital inputs [Avdiu 2022]. Understanding the dynamics of manufacturing TFP is particularly important, given its positive effect on aggregate economic performance. For instance, Jia et al. [2020] studied a sample of developed economies from 1970 to 2011 and found that manufacturing TFP influences economic growth both directly (via aggregate TFP) and indirectly (via capital and labor). However, the study did not find a similar effect coming from non-manufacturing TFP. In measuring firm-level productivity, a particular challenge arises due to the fact that firms typically choose the level of inputs (and output) after learning about their productivity. This results in the well-known simultaneity bias in production-function-based TFP estimation.

When the demand for intermediate inputs is assumed to be dependent on productivity, the log-linearized Cobb-Douglass production function can be expressed as:

$$y_{jt} = \beta_1 l_{jt} + \phi_{jt}(k_{jt}, m_{jt}) + \eta_{jt} \tag{1}$$

where $\phi_{jt}(k_{jt}, m_{jt}) = \beta_0 + \beta_2 k_{jt} + h(k_{jt}, m_{jt})$, $\omega_{jt} = h(k_{jt}, m_{jt})$, y_{jt} is the natural logarithm (ln) of value-added output of firm j at time t, l_{jt} is ln of labor (free variable), k_{jt} is ln of capital stock (state variable that is fixed in the short run), and m_{jt} is ln of intermediate inputs (proxy variable for unobserved productivity). The composite error term, μ_{jt}, consists of a time-varying productivity component specific to the firm, ω_{jt}, and a purely transitory component uncorrelated with input choices, η_{jt}. A key issue in the extraction of TFP from ordinary least squares (OLS) estimates of Equation 1 is that unobservable productivity shocks and input levels are correlated as shown by $\phi_{jt}(\cdot)$ and the control function $h(\cdot)$ [Petrin et al. 2004]. In particular, profit-maximizing firms adjust output level based on the direction of the shock which, in turn, has a corresponding effect on input usage (van Beveren [2012]; Bartelsman and Wolf [2014]). Input variables become endogenous when ω_{jt} is not fully extracted from μ_{jt}, leading to potentially inconsistent estimates.

The literature has advanced significantly in developing techniques that account for this correlation between input levels and unobservable productivity shocks (van Beveren [2012]; Bartelsman and Wolf [2014]). In particular, Olley and

Pakes (OP) [1996] and Levinsohn and Petrin (LP) [2003] developed the earliest approaches to deal with simultaneity issues in productivity and input choices by using the so-called control function approach.[1] Wooldridge [2009] added that the standard two-step semi-parametric procedure in the previous approaches can be simplified by using a generalized method of moments estimation in a one-step setup. Ackerberg et al. [2015] later proposed a modification to correct for the inherent functional dependence problems in the OP and LP methodologies.[2]

In this study, we apply the three-stage semi-parametric LP procedure to recover the unbiased $\widehat{\omega}_{jt}$ using the firm-level panel dataset described in Section 2.1. Total value-added output, number of employees, and capital stock (measured as the depreciation-adjusted book value of buildings, transport equipment, and machinery and equipment) are used as the dependent, free, and state variables, respectively. For the proxy variable, we use intermediate inputs defined as the combined costs of raw materials, electricity, and fuel. Monetary variables are adjusted using the industry GDP deflator with 2018 as the base year. While our dependent variable is revenue-based, controlling for aggregate price movements partly allows us to have a broad sense of the quantity-based TFP, which is considered a purer measure of technical efficiency [Avdiu 2022].

2.3. TFP regressions and decomposition

The TFP estimates are analyzed using regression models that link productivity to various firm-level covariates. The empirical literature has identified several key factors that drive, or at least correlate with, productivity variations across firms—research and development (R&D) and innovation, human capital accumulation, trade openness, strong institutions, and quality infrastructure (UNIDO [2007]; Kim and Loayza [2019]). Kim and Loayza [2019] and Ahmed and Bhatti [2020] also identified managerial quality, firm size, and access to finance as key determinants of productivity growth at the firm level. Investments in information and communication technology (ICT), intangible assets, and digitalization can help sustain firm-level productivity growth (Ahmed and Bhatti [2020]; Roth et al. [2022]). UNIDO [2007] added that market dynamics and resource reallocation within sectors can influence productivity.

Given the longitudinal dataset described in Section 2.1, we can estimate Equation 2 below, which accounts for time-invariant factors such as managerial quality, organizational cultures, and broad institutional endowments and constraints that affect firm productivity:

$$\ln TFP_{jt} = + \gamma_0 + \boldsymbol{x}_{jt}'\boldsymbol{\gamma} + u_j + \delta_t + \varepsilon_{jt} \quad (2)$$

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[1] See Rovigatti and Mollisi [2018] for the technical details of the control function approach.

[2] The earliest estimation algorithms are implemented in Stata using the opreg (for OP) and levpet (for LP) commands. An alternative is the prodest command developed by Rovigatti and Mollisi [2018].

where $\ln TFP_{jt}$ is the ln of TFP of firm j at time t, $\boldsymbol{x}_{jt}$ is a vector of firm-level covariates, $\boldsymbol{\gamma}$ is a vector of coefficients, u_j is the unobserved time-invariant heterogeneity, δ_t controls for time fixed effects, and ε_{jt} is the error term. While standard random effects (RE) and fixed effects (FE) models can easily handle u_j, it is also important to recognize the potential selection bias that may arise from the systematic appearance or non-appearance of certain types of firms in the ASPBI. For instance, we only observe the productivity and other characteristics of firms that survived during the pandemic or those who willingly participated in the surveys despite the lockdowns. To account for this issue, the Heckman selection model adjusts the $\boldsymbol{\gamma}$ estimates in Equation 2 for possible selection bias by explicitly modelling the probability of observing a specific firm j based on its attributes.

The preceding TFP analysis is extended by implementing a decomposition method that breaks down the differential effects of the covariates in certain groups of firms. For instance, decomposition analysis can answer how much of the change in differences in the TFP levels between small, medium-sized, and large manufacturers can be attributed to compositional changes in the groups or to changes in the characteristics of firms. For this kind of exercise, the most popular approach is the Kitagawa–Oaxaca–Blinder (KOB) decomposition method. The basic principle behind the KOB decomposition is to obtain counterfactual estimates for the outcomes of one group, assuming it had the same endowment or structure as the reference group [Kröger and Hartmann 2021].

While the original KOB decomposition was designed for cross-sectional data, Kröger and Hartmann [2021] extended the approach to panel data, which accounts for the time-invariant unobservable effect.[3] This method provides the advantage of analyzing the impact of intertemporal dynamics on the mean differences of the groups being studied. For instance, Kröger and Hartmann's [2021] KOB method for panel data can answer the extent by which accumulated group differences in past tangible investments contribute to the current productivity gap. Similarly, the method can answer what factors account for the widening or narrowing TFP gap among small, medium-sized, and large manufacturers over time.

Given a panel dataset, the KOB decomposition from the perspective of Group 2 is expressed as follows:

$$\Delta \ln TFP_t = \underbrace{[E(\boldsymbol{X}_t^1) - E(\boldsymbol{X}_t^2)]\boldsymbol{\gamma}_t^2}_{\text{endowment effect}} + \underbrace{E(\boldsymbol{X}_t^1)(\boldsymbol{\gamma}_t^1 - \boldsymbol{\gamma}_t^2)}_{\text{structural effect}}$$
$$+ \underbrace{[E(\boldsymbol{X}_t^1) - E(\boldsymbol{X}_t^2)](\boldsymbol{\gamma}_t^1 - \boldsymbol{\gamma}_t^2)}_{\text{interaction effect}} + \underbrace{[E(\boldsymbol{u}^1) - E(\boldsymbol{u}^2)]}_{\text{effect of unobservables}}, \quad (3)$$

where $\boldsymbol{X}^G$ is a matrix of covariates, $\boldsymbol{\gamma}^G$ is a vector of slope coefficients, and $\boldsymbol{u}^G$ contains the time-invariant unobserved factors for group $G = \{1,2\}$. Kröger and

[3] This is implemented in Stata using the xtoaxaca module of Kröger and Hartmann [2021].

Hartmann [2021] explained that the endowment effect (*EE*) accounts for the mean TFP difference that is traced to differences in the two groups' time-varying characteristics; that is, the change in Group 2's TFP if its endowment level is equal to Group 1 at time *t* [Jann 2008]. The structural effect (*SE*) captures the gap due to differences in the model coefficients. Put differently, *SE* measures the change in Group 2's TFP if it had Group 1's coefficients [Jann 2008]. In this study, we can think of the coefficients as partial productivity returns. The interaction effect (*IE*) explains the difference due to the interaction of the two groups' different characteristics and coefficients. Equation 3 implies that KOB decomposition using panel regression models also attributes a portion of the differences between groups to *UE* or the effect of time-invariant or persistent underlying traits of firms.

The change in the TFP difference between the two groups and between two periods, say s and t for $s < t$, is given by:

$$\Delta \ln TFP = \Delta \ln TFP_t - \Delta \ln TFP_s = \Delta \ln TFP^1 - \Delta \ln TFP^2 \tag{4}$$

Depending on the approach, this "difference in differences" can be decomposed into changes in the two groups' TFP gap due to endowment, structural, and interaction effects. For instance, Kröger and Hartmann's [2021] "interventionist approach" proposed the following decomposition:

$$\Delta \ln TFP^1 - \Delta \ln TFP^2 = \Delta EE + \Delta SE + \Delta IE \tag{5}$$

where $\Delta EE = [E(\boldsymbol{X}_t^1) - E(\boldsymbol{X}_s^1)]\gamma_s^1 - [E(\boldsymbol{X}_t^2) - E(\boldsymbol{X}_s^2)]\gamma_s^2$, $\Delta SE = E(\boldsymbol{X}_s^1)(\gamma_t^1 - \gamma_s^1) - E(\boldsymbol{X}_s^1)(\gamma_t^2 - \gamma_s^2)$, and $\Delta IE = [E(\boldsymbol{X}_t^1) - E(\boldsymbol{X}_s^1)](\gamma_t^1 - \gamma_s^1) - [E(\boldsymbol{X}_t^2) - E(\boldsymbol{X}_s^2)](\gamma_t^2 - \gamma_s^2)$. Given no change in the initial differences in coefficients, ΔEE captures the contribution of the changes in the endowments between s and t to the overall TFP gap [Kröger and Hartmann 2021]. On the other hand, given no change in the initial differences in endowments, ΔSE measures the portion of the overall TFP gap that can be traced to adjustments in the coefficients between groups from period s to t. Kröger and Hartmann [2021] suggest that $\Delta UE = [E(\boldsymbol{u}_t^1) - E(\boldsymbol{u}_s^1)] - [E(\boldsymbol{u}_t^2) - E(\boldsymbol{u}_s^2)]$ should be accounted for when the group differentials in time-constant factors are substantial, which may be expected in an unbalanced panel.

3. Stylized facts

Table 2 summarizes the parameter estimates for the log-linearized Cobb-Douglass production function using the LP method. For comparison, we also showed the estimates using pooled OLS (POLS), FE, and RE regressions. Compared to LP1, LP2 controlled for the potential bias due to attrition. However, given our lack of information about true exit versus mere non-inclusion in the survey, misclassifying random missingness as attrition may also result in biased estimates. That said, we will use LP1 in succeeding TFP analyses given that the estimates are close (see Appendix 3). Table 3 confirms that on average, production technology in Philippine manufacturing is still labor intensive, as suggested by the higher elasticity of value-added output with respect to labor than with respect to capital. For the LP method, $\widehat{\beta_1}/\widehat{\beta_2} > 3$, indicating that production is at least three times more responsive to changes in labor than in capital. The second important observation is that the POLS and RE estimates for the labor coefficient are significantly larger than in other methods, confirming Levinsohn and Petrin's [2003] argument that OLS overestimates the parameters of free variables.

TABLE 2. Estimates of production function parameters using various methods

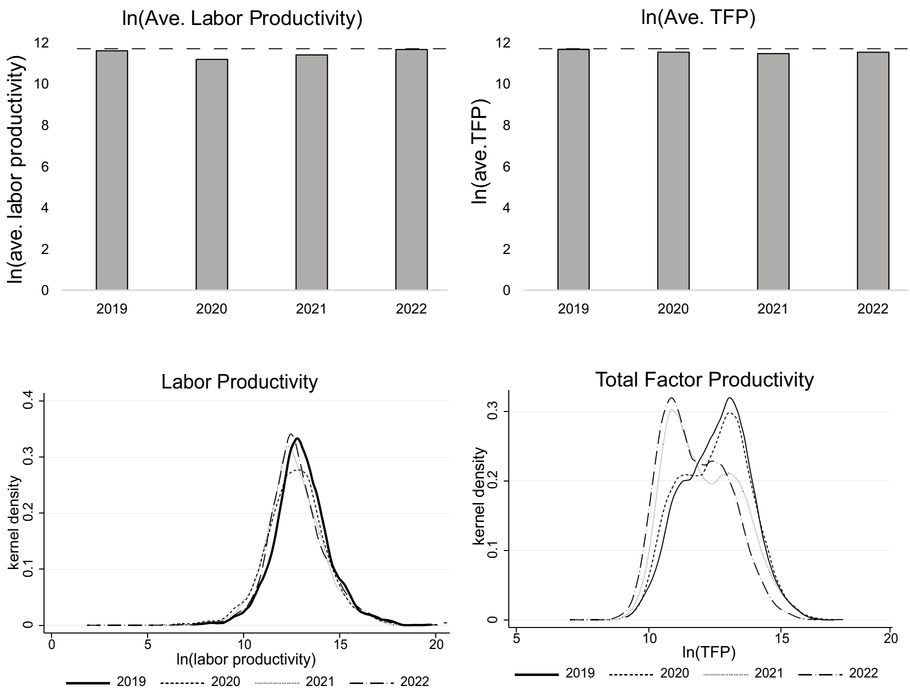
	POLS	RE	FE	LP1	LP2
Labor (ln)	0.886*** (0.012)	0.900*** (0.015)	0.471*** (0.034)	0.475*** (0.012)	0.475*** (0.012)
Capital (ln, 2018 prices)	0.289*** (0.009)	0.236*** (0.010)	0.095*** (0.012)	0.142*** (0.024)	0.160*** (0.024)
No. of observations	15,178	15,178	15,178	15,178	15,178
R-Squared	0.829	0.826	0.747	-	-

Source of raw data: PSA.
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$
POLS – Pooled OLS, RE – Random Effects, FE – Fixed Effects, LP – Levinsohn-Petrin
The dependent variable is ln of value-added output (in 2018 prices). All regressions include industry, region, and year controls. Numbers in parentheses are robust standard errors.

Figure 3 summarizes the evolution of manufacturing TFP before, during, and after the pandemic. For reference, we also showed the labor productivity dynamics from 2019 to 2022. The upper-right panel shows that average TFP dropped in both 2020 and 2021. Recovery was slow, with the average TFP in 2022 still below the 2019 level. Similar to the picture suggested by Figure 1, the distribution of manufacturing TFP in the lower-right panel shifted to the left from 2019 to 2020. This confirms the deterioration of firms' productivity at the height of exponential COVID-19 spread, stringent containment policy, and economic hibernation in 2020. The leftward shift continued through 2021, reflecting the delayed recovery of domestic manufacturing partly due to prolonged lockdowns. The TFP distribution in 2022 remained on the left of the 2019 curve, confirming our earlier observation that manufacturing productivity had been slow to recover to pre-pandemic levels. Another striking pattern is the change in the shape of the distributions, which became more dispersed and right-skewed after 2020. This hints at the two-speed, post-pandemic productivity trend, with relatively high-TFP (and possibly large) manufacturers recovering faster while low-TFP (and most likely small) firms still struggle to cope with the lingering effects of lockdowns and occasional surges in COVID-19 cases.[4]

[4] AMRO [2024] documented a possible scarring effect in the post-pandemic growth of the Philippine economy due to weaker growth in physical capital stock, TFP, and human capital.

FIGURE 3. Dynamics of productivity in Philippine manufacturing, 2019-2022



Source of raw data: PSA.

Table 3 summarizes the average TFP of major manufacturing sectors at the two-digit PSIC level. The erosion of manufacturing productivity in 2020 was observed across the board, demonstrating how the pandemic disrupted productive activities in almost all economic sectors. However, the impact of aggregate COVID-19 shocks was highly heterogeneous, with textiles, paper and paper products, and printing and reproduction of recorded media experiencing more than 40 percent reductions in average TFP. Variations in actual exposure and vulnerability to adverse shocks in input sourcing and supply chains, financing, and demand explain why some sectors fared worse than others. Production technology varies across industries, with relatively labor-intensive sectors severely affected by workers' loss of mobility due to lockdowns.

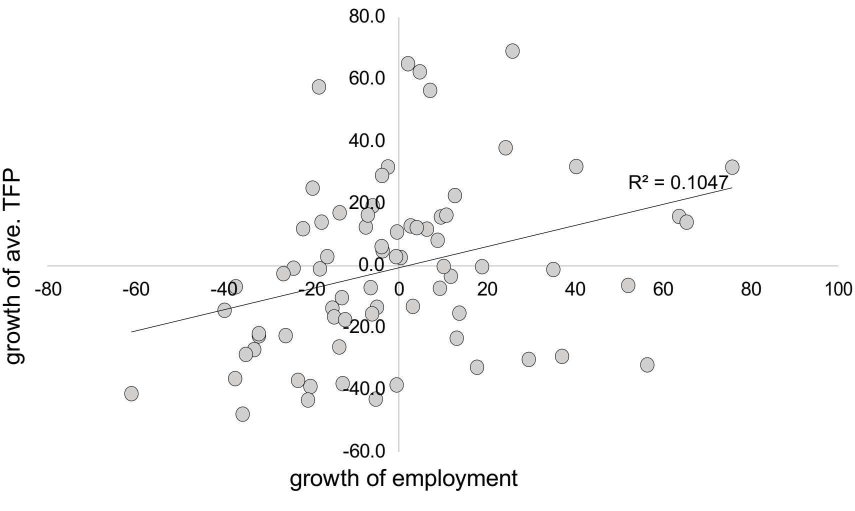
TABLE 3. Average TFP by manufacturing sector, 2019-2022

Two-digit industry description	Level (ln)				Year-on-Year Growth		
	2019	2020	2021	2022	2020	2021	2022
Food Products	12.1	11.8	11.7	11.8	-22.5	-13.3	15.8
Beverages	11.9	11.5	11.2	11.3	-32.6	-22.4	12.5
Tobacco Products	13.8	13.7	14.1	13.5	-13.1	56.6	-43.2
Textiles	13.0	12.3	12.3	12.5	-47.7	-3.4	16.4
Wearing Apparel	12.2	11.8	12.0	11.9	-36.3	22.7	-7.0
Leather and Related Products	12.6	12.1	12.6	12.2	-37.9	62.5	-30.1
Wood and Related Products (excl. Furniture)	12.2	12.1	12.1	12.2	-10.2	2.7	11.8
Paper and Paper Products	13.0	12.4	12.6	12.6	-42.9	25.1	-2.5
Printing and Reproduction of Recorded Media	12.0	11.5	11.3	11.5	-41.1	-13.6	16.3
Coke and Refined Petroleum Products	13.1	13.6	14.1	13.7	65.1	57.7	-31.9
Chemicals and Chemical Products	12.6	12.6	12.4	12.8	3.0	-16.4	38.1
Basic Pharmaceutical Products and Pharmaceutical Preparations	12.7	12.8	12.7	12.9	15.9	-14.3	32.0
Rubber and Plastic Products	12.8	12.5	12.7	12.6	-26.9	19.4	-7.2
Other Non-Metallic Mineral Product	12.8	12.3	12.4	12.4	-38.8	8.3	-1.2
Basic Metals	13.3	12.9	12.9	13.1	-36.9	-0.3	29.2
Fabricated Metal Products, except Machinery and Equipment	12.6	12.3	12.2	12.2	-21.8	-15.4	4.9
Computer, Electronic and Optical Products	13.8	14.1	13.9	14.0	31.8	-17.3	12.3
Electrical Equipment	13.0	13.0	13.0	13.1	-0.7	-6.3	14.1
Machinery and Equipment	12.7	12.7	12.4	12.9	-0.9	-23.3	69.2
Motor Vehicles, Trailers and Semi-Trailers	13.2	13.4	13.5	13.2	14.1	17.1	-29.1
Other Transport Equipment	12.6	12.9	12.9	12.8	31.9	3.0	-15.2
Furniture	12.2	11.9	11.9	12.0	-28.5	-0.2	10.9
Other Manufacturing	12.6	12.3	12.4	12.5	-26.1	12.9	6.2
Repair and Installation of Machinery and Equipment	12.3	12.2	11.8	11.9	-6.7	-38.3	12.0
Low Tech	12.2	11.8	11.7	11.8	-29.5	-10.7	13.8
Low-Medium Tech	12.8	12.4	12.4	12.4	-27.8	-5.0	3.1
High-Medium Tech	12.8	12.9	12.7	12.9	6.3	-10.2	19.8
High Tech	13.5	13.8	13.7	13.8	30.9	-10.5	11.7
All Sectors	12.4	12.1	12.0	12.1	-22.8	-11.2	14.0

Source of raw data: PSA.

As shown in Figure 4, the sectors that experienced the largest productivity losses in 2020 also cut back on labor. This is corroborated by Table 3, which shows that capital-intensive sectors such as coke and refined petroleum products, chemicals and chemical products, basic pharmaceutical products and pharmaceutical preparations, motor vehicles, trailers and semi-trailers, and other transport equipment posted positive average TFP growth in 2020. Moreover, the average TFP of low- and low-medium tech industries fell in 2020, while high-medium and high-tech industries still experienced productivity growth. This divergence implies that the pandemic shock disproportionately disrupted more labor-intensive and SME-dominated sectors while capital-intensive sectors exhibited greater resilience through better capabilities and favorable market position. The degree by which a production activity was considered essential during the pandemic may have also contributed to sectoral variations, with the likes of food and pharmaceuticals allowed to operate at full capacity despite mandatory factory shutdowns in most non-essential activities.[5] For instance, mean TFP, total revenues, and total employment of pharmaceutical manufacturing grew respectively by an average of 11.2 percent, 76.36 percent, and 21.50 percent from 2020 to 2022.

FIGURE 4. Growth of average TFP versus growth of employment across manufacturing sectors, 2020-2022



Source of raw data: PSA

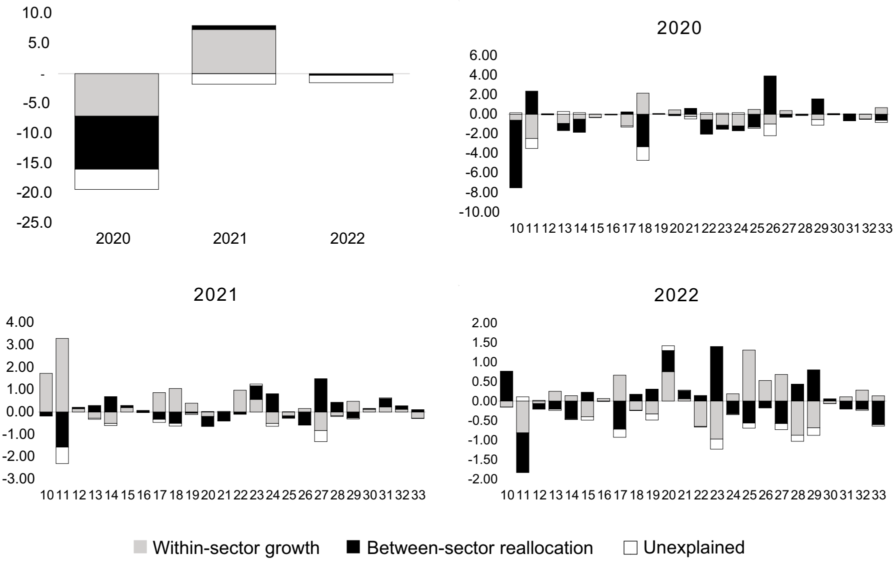
[5] In the Philippines, the following Category I sectors were allowed to operate at full capacity based on the official guidelines released on April 29, 2020 [OP-IATF 2020]: agriculture, fisheries, and forestry; food manufacturing and food supply chain businesses, food retail establishments such as supermarkets and grocery stores, food delivery services; health-related establishments; logistics; information technology and telecommunications; and media. Manufacturers of medicines, medical supplies, devices and equipment were also allowed to operate at full capacity.

Figure 5 decomposes the year-on-year change in manufacturing TFP per worker into within-sector growth and between-sector reallocation according to the following formula:

$$\frac{\Delta y_t}{y_{t-1}} = \frac{1}{y_{t-1}} \left(\sum_i \Big[\underbrace{y_{i,t-1}(s_{i,t} - s_{i,t-1})}_{\text{between}} + \underbrace{s_{i,t-1}(y_{i,t} - y_{i,t-1})}_{\text{within}} + \underbrace{(s_{i,t} - s_{i,t-1})(y_{i,t} - y_{i,t-1})}_{\text{residual}} \Big] \right)$$

where y_t is TFP per worker of the entire manufacturing sector at time t, $y_{i,t}$ is TFP per worker of subsector i at time t, $s_{i,t}$ is share of subsector i in total manufacturing employment at time t. The decomposition shows that the productivity decline in 2020 was mainly driven by negative between-sector reallocation and negative within-sector growth. The negative between-sector reallocation may be partly traced to the movement of workers to lower productivity sectors as manufacturers were forced to scale down operations during the lockdowns, while more traditional manufacturing activities in food and agribusiness were allowed to operate at full capacity. It is also possible that stringent containment policies encouraged the adoption of labor-saving technologies which displaced some workers in high-tech establishments. The negative within-sector growth in 2020 mostly originated from low- and medium-tech manufacturing which were more vulnerable to factory shutdowns, supply chain disruptions, and demand losses. These sectors are also dominated by SMEs which had fewer resources to adopt digital solutions to mobility restrictions. The unexplained source of TFP decline in 2020 may be partly attributed to firm exits and reallocations to precarious non-manufacturing jobs during the crisis. In 2021, within-sector growth—especially in food products, beverages, paper and paper products, printing and reproduction of recorded media, coke and refined petroleum products, rubber and plastic products, other non-metallic mineral products, motor vehicles, and trailers and semi-trailers—supported the rebound of manufacturing productivity. This is consistent with the observation of de Nicola et al. [2025] that productivity growth in East Asia and the Pacific, which includes the Philippines, has been mainly driven by within-firm changes. However, Figure 2 suggests that the recovery in 2021 was not sustained in 2022 due to heterogeneity in within-sector and between-sector growth. Large offsetting movements in within- and between-sector reallocations were observed in food products, paper and paper products, other non-metallic mineral products, fabricated metal products, computer, electronic and optical products, electrical equipment, machinery and equipment, and motor vehicles, trailers and semi-trailers. Chemicals and chemical products and basic pharmaceutical products and pharmaceutical preparations stood out in 2022 for having positive within- and between-sector growth in average TFP per employee.

FIGURE 5. Decomposition of the growth of sectoral TFP per worker, 2020-2022



Source of raw data: PSA.

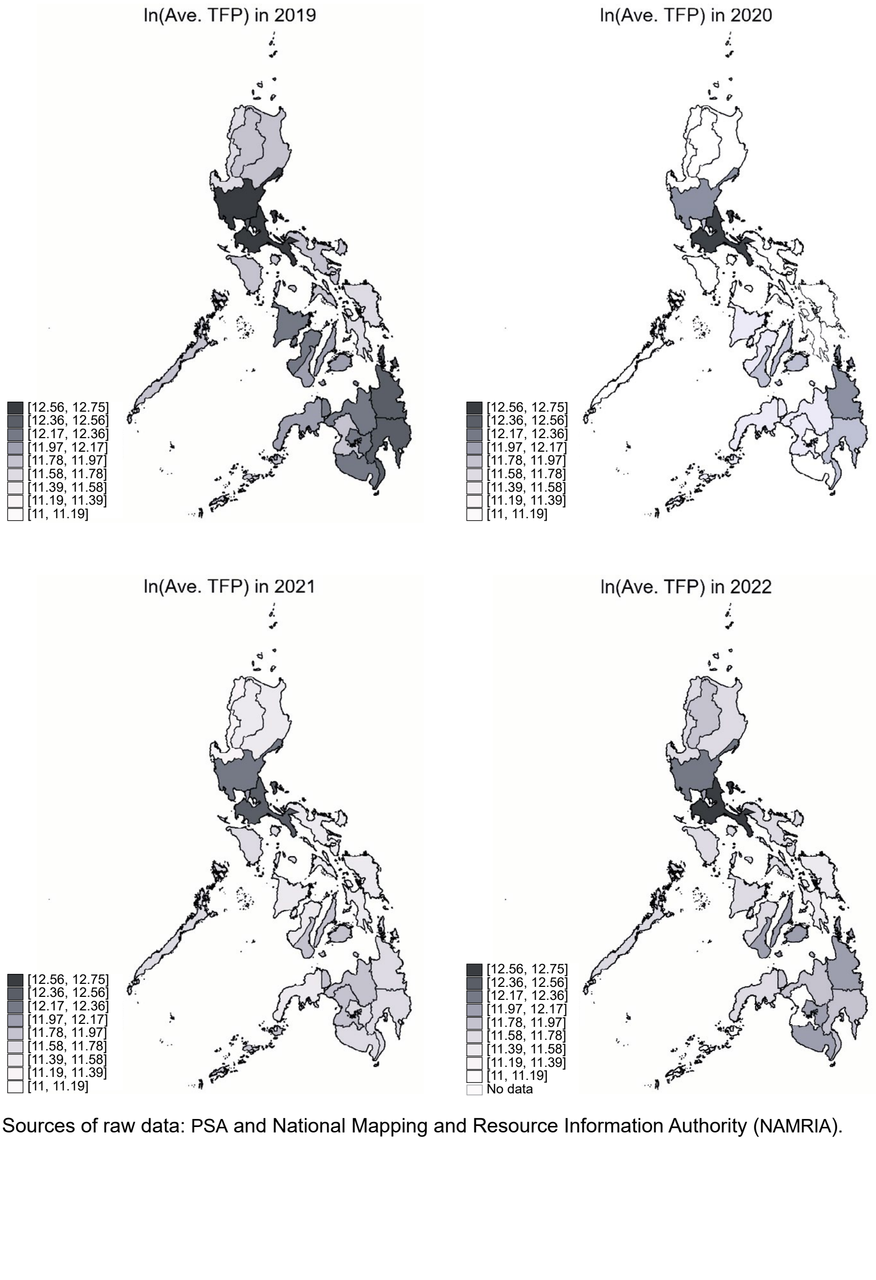
Two-Digit PSIC codes: 10 - Food Products, 11 - Beverages, 12 - Tobacco Products, 13 - Textiles, 14 - Wearing Apparel, 15 - Leather and Related Products, 16 - Wood and Related Products (excluding Furniture), 17 - Paper and Paper Products, 18 - Printing and Reproduction of Recorded Media, 19 - Coke and Refined Petroleum Products, 20 - Chemicals and Chemical Products, 21 - Basic Pharmaceutical Products and Pharmaceutical Preparations, 22 - Rubber and Plastic Products, 23 - Other Non-Metallic Mineral Products, 24 - Basic Metals, 25 - Fabricated Metal Products, except Machinery and Equipment, 26 - Computer, Electronic and Optical Products, 27 - Electrical Equipment, 28 - Machinery and Equipment, nec, 29 - Motor Vehicles, Trailers and Semi-Trailers, 30 - Other Transport Equipment, 31 - Furniture, 32 - Other Manufacturing, 33 - Repair and Installation of Machinery and Equipment

Figure 6 shows the variations in manufacturing TFP across regions and across time from 2019 to 2022. The color intensity of the maps noticeably dimmed in Region 3 (Central Luzon) and the National Capital Region (NCR) between 2019 and 2020, suggesting that productivity in these highly industrialized and export-oriented regions was heavily affected by pandemic shocks to supply chains and foreign demand. For instance, ADB [2020] reported that firms, especially in NCR, were heavily burdened by bottlenecks in customs processes and logistics services.[6] Nevertheless, manufacturing in the rest of the country also experienced significant productivity losses in 2020, especially in Region 4B (Mimaropa), Region 5 (Bicol), and Region 7 (Western Visayas). Protracted lockdown-induced disruptions and policy uncertainties caused the continued decline of productivity

[6] In China, Huang et al. [2022] found that COVID-19 negatively affected TFP growth in cities more than in rural areas. Excessively stringent containment measures such as lockdowns dampened productivity in urban areas where economic activities rely heavily on interconnected supply chains and physical mobility. According to the World Bank [2022], Philippine firms in urban areas, where most manufacturers are located, also faced higher operating costs and heavier burden of compliance to stricter lockdown measures.

in most regions in 2021, especially Region 4A (Calabarzon), which noticeably dimmed compared to 2020. By the end of 2022, Calabarzon was already close to returning to its 2019 average productivity, while other regions were relatively slower to recover.

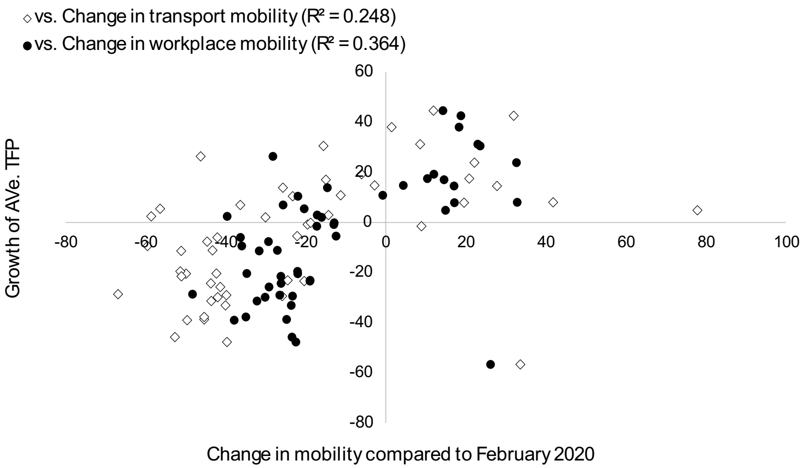
FIGURE 6. Average manufacturing TFP by region, 2019-2022



Sources of raw data: PSA and National Mapping and Resource Information Authority (NAMRIA).

Figure 7 shows that the regional variations in TFP dynamics is positively associated with transport and workplace mobility. This suggests that average TFP declined in regions that experienced significant loss of transport and workplace mobility relative to the pre-pandemic baseline in February 2020.

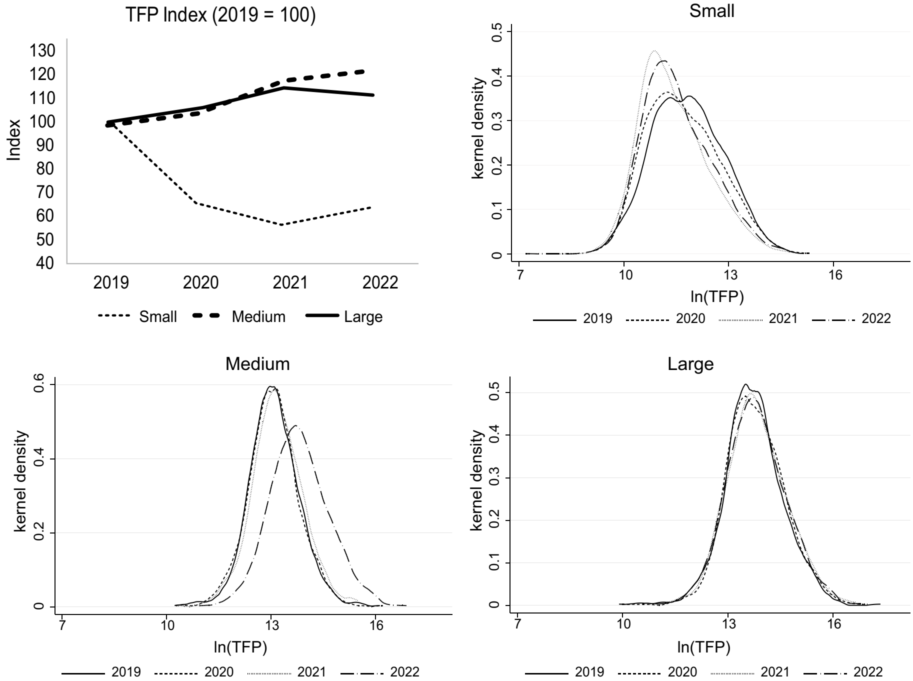
FIGURE 7. Growth of average TFP per region vs. average change in mobility, 2020-2022



Sources of raw data: PSA and Google COVID-19 Community Mobility Reports.

Figure 8 illustrates the TFP evolution of small, medium-sized, and large manufacturers from 2019 to 2022. The top left panel shows that productivity growth in medium and large manufacturers slowed down in 2020, while small firms endured a 34.72 percent TFP decline. Their post-pandemic recovery markedly diverged. The average TFP of large firms inched up in 2021, but fell by 2.44 percent in 2022. In contrast, the average productivity of SMEs contracted further by 12.38 percent in 2021, before recovering by 13.75 percent in 2022. The kernel distributions confirm this divergence. For small manufacturers, the distribution of TFP increased in dispersion and shifted leftward from 2019 to 2020. This suggests that the adverse productivity impact of the pandemic was more heavily felt by microenterprises. From 2020 to 2021, the distribution further moved leftward, with more small firms concentrating in a lower mean. Despite the rightward shift after 2021, the TFP distribution of small manufacturers in 2022 remained stochastically dominated by its pre-pandemic position. Medium-sized manufacturers seem more resilient than small and large firms, with their TFP distribution in 2020 and 2021 virtually unchanged from the 2019 position. By 2022, their TFP distribution already stochastically dominated the pre-pandemic position. The TFP distribution of large firms does not show significant movements between 2019 to 2022, suggesting that the productivity growth of this group slowed despite being robust during the pandemic.

FIGURE 8. Evolution of manufacturing TFP by size, 2019-2022



Source of raw data: PSA.

4. Regression analysis and KOB decomposition

Table 4 summarizes the TFP regression results based on Equation 2. Table 5 shows the estimates for SMEs only. Note that each covariate is tested individually for exogeneity using two-stage, least squares regressions, with the lagged explanatory variable used as instrument (see Appendix 4). The results do not point to any serious endogeneity issue at five percent, justifying the contemporaneous model specification in Equation 2. We reported FE rather than RE estimates based on the results of the Hausman tests. Column 5 summarizes the "naïve" FE regression results using the entire unbalanced sample. However, we caution that these estimates have not been fully adjusted for potential selection bias due to computational limitations in addressing the issue when using panel data. As partial robustness checks, we compared the results to the Heckman regression estimates using the pooled dataset (column 2) and the restricted FE regression results using the balanced panel of firms that consistently appeared in the sample from 2019 to 2020 (column 3). While the Heckman and FE estimates are not directly comparable, the Heckman regressions support the statistically significant results in the FE models. The magnitudes and significance of the FE estimates using the balanced and unbalanced datasets are broadly consistent, suggesting that the latter results are not purely driven by attrition of inferior firms and/or selfselection of highly productive manufacturers. The estimates in columns 4 and 5 are also close, suggesting that the addition of conservatively defined dummy variables do not distort the coefficients of the continuous variables (see Appendix 1 for the variable descriptions). Formal FE Heckman estimates for panel data were not obtained due to computational limitations. Nevertheless, column 6 reports the estimates after controlling for the inverse Mills ratio to partly correct for the potential selection bias.

For the entire sample, columns 5 and 6 show that age (ln), total hours worked (ln), average compensation (ln), and tangible investment have positive and significant relationships with ln*TFP*. We used total hours worked to proxy for the retained capacity of firms to operate amidst a highly uncertain business and policy environment caused by lockdowns, supply chain disruptions, and economic hibernation.[7] Adjusting work hours was one of the key strategies adopted by manufacturers to optimize their limited manpower amidst government-mandated suspensions of operations. This implies that during the pandemic, productivity was likely driven by how well manufacturers were able to remain operational even with minimal new innovation and investment activities.[8] In particular, an increase in total working hours by ten percent is matched by a 0.83 percent increase in expected TFP, *ceteris paribus*. This suggests that efficient labor utilization, despite labor productivity losses due to layoffs, sickness, mobility restrictions, and reduced capacity remained a key contributor to TFP growth during the pandemic. This may be expected given that among the covariates, total working hours is relatively variable which firms can flexibly adjust in the face of adverse shocks. This is consistent with the argument of Nadiri and Rosen [1969] that in the face of demand shocks, firms quickly adjust labor utilization rates though capital is inflexible in the short run. The World Bank's [2020; 2021] COVID-19 surveys also documented labor adjustments as the prevalent type of response adopted by Philippine businesses during the pandemic, while technological investments and digital solutions were less common.

Since TFP is a measure of how production can expand without having to increase labor and capital inputs, column 6 indicates that manufacturers with broader experience (as proxied by age) and more skilled human capital were better able to compensate for the lost capacity induced by lockdowns. According to column 6, a unit change in ln of age is associated with a 0.124 increase in ln*TFP*, holding other factors constant. We follow Vu et al.[2025] by using compensation per worker (ln) as proxy for human capital at the firm level, since higher wages strongly correlate with workers' skill level. All other factors equal, column 6 suggests that a ten-percent increase in average compensation is associated with at least 1.26 percent increase in average TFP. Across models, human capital consistently posted one of the largest average marginal effects, indicating its core relevance in driving productivity in

[7] We thank the first reviewer for this suggestion.

[8] In the UK, Bloom et al. [2022] documented that TFP dropped by 5 percent between 2020 and 2021 due to reduced capacity utilization and higher input costs.

Philippine manufacturing during the pandemic. This implies that manufacturers with the most skilled workforce were better able to manage the disruptions caused by COVID-19. This result is broadly consistent with the productivity literature which identifies education, skills development, and training as important determinants of both innovation and productivity.

Lastly, columns 5 and 6 suggest that capital deepening has a robust positive and significant relationship with productivity growth during the pandemic. Controlling for other factors, manufacturers with investment in tangible assets also enjoyed at least 0.036 percent premium in average TFP. This partly reflects efforts of manufacturers to adjust their production in the context of limited mobility of workers and reduced production capacity in factories. In the ASPBI, investment in tangible assets aggregates capital spending on machinery and equipment, which includes ICT (e.g., computer and peripherals, telecommunications equipment), specialized industrial machinery, general industrial machinery and equipment (e.g., air conditioning and refrigeration equipment, pumps and compressor, power generating equipment), and other machinery and equipment (e.g., photographic equipment and optical goods). This suggests that capital-intensive manufacturers possibly responded to lockdowns, social distancing, and mobility restrictions partly through digital solutions, automation, and labor-saving technologies.

Other factors such as foreign ownership, importing, and exporting activities are significant in the pooled Heckman regression but not in the FE model. This means that despite significant cross-sectional heterogeneity, none of these covariates strongly affected the within-firm TFP changes across time. Interestingly, column 6 indicates that the significance of access to finance and R&D spending in column 5 is not robust. This suggests that the productivity effect detected in column 5 may have been driven by the non-random sample selection of firms with the said characteristics. For instance, financially-connected and R&D-intensive manufacturers have a higher chance of surviving the pandemic and being included in the sample. Therefore, the initial significance of financial access and R&D spending may only be relevant for these firms. For instance, a related survey of 454 firms in Central Luzon, Calabarzon, Central Visayas, and NCR found that businesses with large R&D investment before the pandemic were more resilient [ITC 2020]. Only 60 percent of firms with high R&D spending in 2019 reported to have been strongly affected by the pandemic. In contrast, 83 percent of companies with little pre-pandemic innovative activities were severely hit in 2020. R&D activities drive technological change within the firm, which can cause improvements in process efficiency, product diversification and quality, and overall productivity. In addition to the direct effects of R&D, ITC [2020] also highlighted that innovativeness signals a firm's adaptability and internal capacity to leverage its resources to deal with shocks and emerging market trends. This agility allowed some companies (e.g., San Miguel Corporation, Gouache, and Proctor & Gamble) to temporarily repurpose their processes to produce essential goods such as medical-grade and cloth face masks, alcohol and hand sanitizers, testing kits, personalized protective equipment, and other health-related products.

The dummy for intangible assets is weakly significant at 10 percent in column 6, reflecting generally limited investment of Philippine manufacturers on computer software and databases. Put differently, the slow post-pandemic TFP recovery of manufacturers, especially SMEs, may be partly driven by their lack of intangible technological assets which are vital for creating digital solutions to the disruptions caused by COVID-19. However, this may also mean that investment in intangible assets stagnated during and after the pandemic as resources were diverted to flexible resources (i.e., new equipment, training, and re-skilling) that can generate more immediate impact on raising revenues. Figure 2 suggests that this result was mainly driven by SMEs, given that their technological investment stalled after the pandemic.

Columns 5 and 6 of Table 5 show that efficient labor utilization and human capital are the only robust covariates of SMEs' productivity during the pandemic, suggesting that labor is the primary resource of smaller manufacturers. The dummy for tangible investment is not significant in column 6 of Table 5, suggesting that the productivity gains associated with investment in tangible assets are more relevant for large firms than for SMEs. This is intuitive given that these resources are naturally associated with-large scale manufacturing. The dummy variables for access to finance and positive R&D spending are also insignificant for SMEs. The limited productivity effect of financial access among SMEs aligns with the observation that many small businesses relied more on liquidation of assets, non-bank and informal lenders, and loans from family and friends [World Bank 2020, 2021]. In contrast, large corporations have access to a wider range of financing options, including borrowing from headquarters and partner firms, as well as equity financing. Similar to the full sample, the R&D dummy became insignificant for the productivity of SMEs after controlling for potential selection bias. This indicates that the initial positive productivity effect found in column 5 of Table 5 may be traced to non-random selection into R&D activities, driven by underlying characteristics such as superior managerial capability, stronger financial resources, or a culture of innovativeness. For SMEs, the dummy for intangible assets is also weakly significant at 10 percent in column 6, suggesting limited SME investment in these technologies despite their potential productivity-enhancing effect. Despite being highly significant in column 6 of Table 4, government subsidy is significant only at 10 percent in column 6 of Table 5, consistent with the World Bank's [2022] observation that smaller firms lacked awareness about public support programs, while actual uptake was discouraged by complex requirements and administrative hurdles. Larger firms benefited from these programs more than SMEs.[9]

[9] Various Philippine government agencies extended programs to address the financing needs of SMEs during the pandemic, such as the 60-billion-peso MSME Credit Guarantee Program of the Philippine Guarantee Corporation, the one-billion-peso loan facility of the Small Business Corporation, and the central bank's proactive measures to encourage commercial banks to provide more lending to SMEs [ADB 2020].

TABLE 4. TFP **regressions for Philippine manufacturing, 2019-2022**

	Heckman (Pooled Data)	Fixed Effects (Balanced Panel)	Fixed Effects (Unbalanced Panel)		
Foreign ownership (%)	-0.001***	-0.001	0.000	0.000	-0.001
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Age (ln)	0.073***	0.051*	0.042*	0.040*	0.124***
	(0.014)	(0.028)	(0.022)	(0.022)	(0.044)
Total hours worked (ln)	0.276***	0.090***	0.083***	0.083***	0.083***
	(0.009)	(0.020)	(0.011)	(0.011)	(0.021)
Average compensation (ln)	0.350***	0.145***	0.138***	0.133***	0.126***
	(0.011)	(0.018)	(0.013)	(0.012)	(0.019)
Capacity utilization rate (%)	0.000	0.000	0.000	0.000	0.000
	(0.001)	(0.001)	(0.000)	(0.000)	(0.001)
Importer only (dummy)	0.129***	-0.027		-0.017	0.064
	(0.034)	(0.081)		(0.054)	(0.088)
Exporter only (dummy)	0.115***	0.067		0.063	0.067
	(0.032)	(0.053)		(0.045)	(0.068)
Importer and exporter (dummy)	0.061**	-0.042		-0.017	0.017
	(0.029)	(0.086)		(0.058)	(0.096)
R&D spending (dummy)	0.007	0.047**		0.056***	0.026
	(0.029)	(0.024)		(0.020)	(0.027)
Access to finance (dummy)	0.055**	0.028		0.040**	0.026
	(0.022)	(0.024)		(0.020)	(0.027)
Tangible investment (dummy)	0.101***	0.045***		0.053***	0.036**
	(0.021)	(0.016)		(0.013)	(0.017)
Intangible investment (dummy)	0.066	0.039		0.023	0.049*
	(0.042)	(0.029)		(0.025)	(0.029)
Government subsidy (dummy)	-0.052	0.121*		0.065	0.148**
	(0.060)	(0.063)		(0.045)	(0.069)
Inverse Mills ratio	Yes	No	No	No	Yes
Number of observations	13,349	3,515	13,349	13,349	4,534
Within R^2		0.122	0.102	0.111	0.100

Source of raw data: PSA

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$

The dependent variable is ln*TFP*. All regressions include controls for size, sector (at the three-digit PSIC level), region, and year. All explanatory variables passed the test for exogeneity using the two-stage least squares, with their respective lagged values as instruments. Numbers in parentheses are cluster-robust standard errors, with Establishment Control Number (ECN) as the cluster variable. For the Heckman regression, the selection equation models the probability of being observed in the next period based on foreign ownership, age (ln), total hours worked (ln), average compensation (ln), capacity utilization, total employees (ln), region, sector (at the three-digit PSIC level), and year. Consistent with the Heckman methodology, column 6 was estimated using only the non-censored observations in the selection equation. The inverse Mills ratios are significant in columns 2 and 6. The Hausman tests suggest that the FE regressions are more appropriate for the data than the RE regressions.

TABLE 5. TFP regressions for Philippine manufacturing SMEs, 2019-2022

	Heckman (Pooled Data)	Fixed Effects (Balanced Panel)	Fixed Effects (Unbalanced Panel)		
Foreign ownership (%)	-0.002*** (0.000)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	-0.001 (0.001)
Age (ln)	0.051*** (0.017)	0.025 (0.035)	0.025 (0.026)	0.026 (0.026)	0.123* (0.064)
Total hours worked (ln)	0.257*** (0.012)	0.103*** (0.028)	0.083*** (0.015)	0.082*** (0.015)	0.103*** (0.029)
Average compensation (ln)	0.335*** (0.014)	0.154*** (0.025)	0.131*** (0.015)	0.127*** (0.015)	0.115*** (0.026)
Capacity utilization rate (%)	0.000 (0.001)	0.001 (0.001)	0.001 (0.000)	0.001 (0.000)	0.000 (0.001)
Importer only (dummy)	0.167*** (0.043)	0.049 (0.107)		0.036 (0.065)	0.202* (0.111)
Exporter only (dummy)	0.107*** (0.040)	-0.003 (0.083)		0.090 (0.062)	0.045 (0.113)
Importer and exporter (dummy)	0.113*** (0.039)	-0.093 (0.119)		0.005 (0.075)	0.044 (0.116)
R&D spending (dummy)	0.008 (0.040)	0.055 (0.034)		0.093*** (0.026)	0.040 (0.040)
Access to finance (dummy)	0.070** (0.028)	0.004 (0.035)		0.024 (0.026)	0.007 (0.039)
Tangible investment (dummy)	0.075*** (0.028)	0.023 (0.022)		0.041** (0.017)	0.004 (0.026)
Intangible investment (dummy)	0.020 (0.067)	0.051 (0.045)		-0.002 (0.036)	0.088* (0.051)
Government subsidy (dummy)	-0.146* (0.083)	0.155* (0.089)		0.065 (0.055)	0.174* (0.092)
Inverse Mills ratio	Yes	No	No	No	Yes
Number of observations	10,708	1,977	10,708	10,708	2,963
Within R^2		0.115	0.089	0.096	0.091

Source of raw data: PSA.
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$
The dependent variable is ln*TFP*. All regressions include controls for size, sector (at the three-digit PSIC level), region, and year. All explanatory variables passed the test for exogeneity using the two-stage least squares, with their respective lagged values as instruments. Numbers in parentheses are cluster-robust standard errors, with Establishment Control Number (ECN) as the cluster variable. For the Heckman regression, the selection equation models the probability of being observed in the next period based on foreign ownership, age (ln), total hours worked (ln), average compensation (ln), capacity utilization, total employees (ln), region, sector (at the three-digit PSIC level), and year. Consistent with the Heckman methodology, column 6 was estimated using only the non-censored observations in the selection equation. The inverse Mills ratios are significant in columns 2 and 6. The Hausman tests suggest that the FE regressions are more appropriate for the data than the RE regressions.

The preceding discussions showed that the revenues, employment, and productivity of SMEs and large manufacturers have diverged markedly after the pandemic. Large firms quickly rebounded from the temporary setback in 2020, while SMEs struggled to return to pre-pandemic level. However, a closer look at SMEs suggests that the productivity of small and medium-sized manufacturers is also drifting apart. Figure 8 shows that medium-sized firms have already surpassed their pre-pandemic productivity, while the performance of small firms stalled. This phenomenon has important implications on policy given that most government programs and interventions target the two categories as one big group. However, significant distinctions suggest that the two have size-specific needs that should be treated differently. We further investigated this divergence using the KOB decomposition method described in Section 2.3. At the onset, we justify the use of KOB decomposition based on sufficient overlaps in the kernel densities of small and medium-sized firms across the covariates used (see Appendix 5). Yet, Figure 8 shows that their respective TFP distributions markedly diverge. The results summarized in Table 6 confirm that the average ln*TFP* gap between small and medium-sized manufacturers have widened significantly from 1.936 in 2019 to 2.482 in 2022. To be at par with medium-sized manufacturers, small producers needed more endowments in 2021 and 2022 compared to what was required in 2019 and 2020. This is consistent with the divergence argument, which implies a further marginalization of SMEs' contribution in manufacturing TFP growth given that large firms are close to regaining their pre-pandemic productivity.

The estimates point to differences in endowments and time-constant or persistent underlying traits as the biggest sources of ln*TFP* gap between small and medium-sized manufacturers. The structural and interaction effects are insignificant at five percent, indicating the broad similarity of the production technologies of the two groups. The *EE* alone accounted for 15.44 percent of the gap in 2022, up from 12.72 percent in 2019. This was mainly traced to large differences in foreign ownership, total hours worked, and capacity utilization. Their limited resources to respond to the disruptions suggest that the TFP slowdown of small firms during and after the pandemic was the natural consequence of their size. The *EE* estimate in 2019 indicates that the average ln*TFP* of small firms would have increased by 0.246 if they had the same resources as medium-sized manufacturers. This endowment gap further widened during and after the pandemic—from 0.266 in 2020 to 0.375 and 0.383 in 2021 and 2022, respectively. This steady rise highlights the role of differential resource access, which exacerbated during the pandemic, in the growing productivity gap between the two groups. This is consistent with the World Bank [2022] survey suggesting that two years after the Great Lockdown, smaller Philippine firms remained disproportionately burdened by weak cash flows and ongoing arrears *vis-à-vis* limited access to formal finance, cautious hiring due to operational constraints, and inadequate capacity and infrastructure for digital solutions.

TABLE 6. KOB decomposition of the ln*TFP* gap between small and medium-sized manufacturers, 2019-2022

	2019	2020	2021	2022
EE	0.246***	0.266***	0.375***	0.383***
	(0.052)	(0.057)	(0.065)	(0.059)
	[12.722]	[12.745]	[14.761]	[15.442]
SE	0.178*	0.169*	0.277*	0.142
	(0.082)	(0.078)	(0.132)	(0.117)
	[9.203]	[8.083]	[10.900]	[5.724]
IE	-0.069	-0.085	-0.225	-0.092
	(0.078)	(0.077)	(0.128)	(0.116)
	[-3.553]	[-4.059]	[-8.848]	[-3.699]
UE	1.580***	1.738***	2.114***	2.049***
	(0.066)	(0.063)	(0.072)	(0.065)
	[81.628]	[83.231]	[83.188]	[82.533]
Total	1.936***	2.088***	2.542***	2.482***
	(0.040)	(0.040)	(0.038)	(0.032)

Source of raw data: PSA.
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$
EE – endowment effect, *SE* – structural effect, *IE* – interaction effect, *UE* – effect of unobservable traits
Due to the computational limitations, regional fixed effects only control for major island groups (i.e., Visayas and Mindanao, with Luzon as the baseline), while sectoral fixed effects only control for broad groupings by level of technology (i.e., medium-low tech, medium-high tech, and high tech, with low tech as the baseline). Numbers in parentheses are bootstrapped standard errors. Number in square brackets are percentage shares in total ln*TFP* gap per year.

Time-constant unobservable factors are the dominant source of productivity differences between small and medium-sized manufacturers. This suggests that medium-sized firms are not simply scaled up versions of small firms. Their inherent heterogeneity in managerial quality, organizational structures, and innovation culture, may have contributed to the documented pre-pandemic ln*TFP* gap, which further widened after 2020. Locational disadvantages may have also exacerbated small firms' limited access to resources, especially in sectors or regions that are distant from public goods and markets. ITC [2020] also suggest that networks and relationships with clients and suppliers matter. These connections provide vital information about market trends, regulations, emerging business practices, and technologies which manufacturers can use to upgrade their operations. ITC [2020] observed that producers connected to their buyers, especially large companies, are more likely to innovate and have a business plan. However, in the Philippines, smaller firms have low tendency to form strong connections to clients, on top of their already limited forward and backward linkages with large businesses [ITC 2020].

TABLE 7. KOB decomposition of the change in the ln*TFP* gap between small and medium-sized manufacturers, 2020-2022

	2020	2021	2022
ΔEE	0.031	0.089**	0.059
	(0.026)	(0.032)	(0.030)
	[20.412]	[14.613]	[10.772]
ΔSE	-0.025	-0.036	0.011
	(0.030)	(0.035)	(0.035)
	[-16.384]	[-5.944]	[1.960]
ΔIE	-0.012	0.019	0.008
	(0.013)	(0.017)	(0.019)
	[-7.602]	[3.161]	[1.531]
ΔUE	0.158***	0.534***	0.469***
	(0.044)	(0.049)	(0.050)
	[103.574]	[88.171]	[85.738]
Total	0.153***	0.606***	0.546***
	(0.043)	(0.046)	(0.045)

Source of raw data: PSA.
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$
EE – endowment effect, *SE* – structural effect, *IE* – interaction effect, *UE* – effect of unobservable traits
Due the computational limitations, regional fixed effects only control for major island groups (i.e., Visayas and Mindanao, with Luzon as the baseline), while sectoral fixed effects only control for broad groupings by level of technology (i.e., medium-low tech, medium-high tech, and high tech, with low tech as the baseline). Numbers in parentheses are bootstrapped standard errors. Number in square brackets are percentage shares in the change in ln*TFP* gap per year.

Finally, Table 7 summarizes the results of the decomposition of change based on Equation 5. The estimates confirm that the rate of change in endowment differences between small and medium-sized manufacturers accelerated in 2021, which contributed to the wider overall ln*TFP* gap between the two groups. Another interesting observation is the relatively large share of ΔEE in 2020, suggesting that small firms were disproportionately burdened by COVID-19 disruptions early on due to their limited resources. Small firms' weak performance in 2021 and 2022 indicates that they still haven't fully recovered from this shock two years after the pandemic. The rate of change in the TFP differential due to persistent unobservable traits also accelerated from 0.158 in 2020 to 0.534 in 2021 and 0.469 in 2022, emphasizing the relevance of inherent time-invariant traits such as managerial quality, organizational culture, location, and networking ability in dealing with adverse shocks. Therefore, addressing the increasing productivity spread between small and medium-sized manufacturers should focus on interventions that upgrade smaller firms' core competencies and improve their access to resources. To a certain extent, this will involve easing the regulatory burden implemented during the pandemic which created a harsh business environment that disproportionately affected SMEs. In contrast, ΔSE and ΔIE are consistently insignificant across years. This may be explained by the relatively stable coefficients of the two groups of manufacturers, given that production structures are not expected to change drastically in the short run.

5. Concluding remarks

This paper used 2019 to 2022 data from the ASPBI to obtain updated estimates of establishment-level TFP and construct stylized facts about the post-pandemic productivity dynamics of Philippine manufacturers, especially SMEs. The results confirm the severe but highly heterogenous productivity impact of the pandemic across sectors and regions. Low-tech sectors experienced bigger TFP declines compared to high-tech sectors. Manufacturing productivity in major industrial and export-oriented regions were badly hit by pandemic-induced supply chain shocks partly due to mobility restrictions, but recovery was highly uneven. The results also reveal the divergent post-pandemic TFP dynamics between SMEs and large manufacturers, with the latter experiencing large productivity losses in 2020 but gradually recovering in 2021. Medium-sized manufacturers were surprisingly resilient, with their TFP in 2022 already surpassing the 2019 benchmark. Small manufacturers, especially microenterprises, not only endured the biggest productivity loss in 2020 but also struggled to return to pre-pandemic level.

The FE regressions suggest that Philippine manufacturing TFP during the pandemic was primarily driven by total hours worked, human capital (proxied by average compensation), experience (proxied by age), and tangible investment. This suggests that highly productive manufacturers compensated their reduced production capacity through efficient labor utilization, skilled manpower, and capital deepening, which enabled agile business adjustments amidst restricted mobility of workers, limited operations in factories, supply chain disruptions, and negative demand shocks. However, the productivity premia from R&D spending, access to finance, and intangible investment are not robust. Other factors such as foreign ownership, capacity utilization, and trading activity were insignificant in the FE model that accounted for within-firm TFP variations across time.

A closer look at SMEs revealed the deviant post-pandemic TFP recovery of small and medium-sized firms. Further decomposition of this divergent pattern suggests that differences in endowments and persistent underlying traits are the biggest sources of the productivity gap between small and medium-sized manufacturers, while the structural and interaction effects are insignificant. The endowment effect was mainly driven by large gaps in foreign ownership, total hours worked, and capacity utilization, suggesting that the slow post-pandemic TFP recovery of small firms was naturally constrained by their size. The large productivity gap traced to time-invariant unobservable characteristics emphasize the relevance of persistent underlying traits such as managerial quality, organizational culture, location, and networking ability in dealing with adverse shocks. Decomposition by year further showed that the endowment and unobserved effects increased from 2019 to 2022, which implies that to catch up with medium-sized manufacturers, small firms needed more resources in 2022 compared to the requirement in previous years. Decomposition of change also indicated that the change in the productivity gap due to endowment and unobserved fixed effects accelerated, which resulted in a TFP differential in 2022 that was wider than in 2020. The productivity divergence between small and medium-sized manufacturers calls for a careful reassessment of blanket programs that do not distinguish between the two groups. Poorly-targeted interventions may further marginalize SMEs' contribution in manufacturing TFP growth given that large firms are close to regaining their pre-pandemic productivity.

The empirical results broadly align with the kinds of support requested by firms from the government during and after the pandemic (ADB [2020]; UNIDO [2020]; World Bank [2020; 2021; 2022]). For instance, UNIDO [2020] and World Bank [2020] documented strong and urgent demand for government support for liquidity-improving measures (e.g., cash transfers, new loans with lower interest rates, deferral of loan payments, credit mediation and refinancing, loan restructuring), wage subsidies, flexible work arrangements and labor policies, health- and mobility-improving policies, digital skills training, and digital technology adoption during the early phase of the lockdowns. ADB [2020] also noted demand for support for rehiring and re-skilling displaced workers, capacity building for e-commerce and remote operations, and support for investment in digital infrastructure. By 2021, firms were requesting for free and preferential access of their employees to vaccines when they became available [World Bank 2022]. Clearly, these desired government interventions are justified by the empirical results which suggest that firms, especially SMEs, needed to improve their production workforce, capacity utilization, access to finance, and investment in digital assets in order to boost their post-pandemic productivity. However, the aforementioned reports also observed low awareness and actual uptake of the support programs rolled out by the government during the pandemic. Moreover, larger firms benefited more than SMEs. An important lesson here is that in times of adverse shocks, there is value in implementing frequent business pulse surveys that can provide an accurate sense of the situation and needs of establishments, especially SMEs. However, while timely policy support matters for the survival of businesses, information dissemination, proper targeting, and efficient implementation are also important to ensure that the assistance will reach those who actually need it.

The generally slow post-pandemic recovery of manufacturing TFP, which was largely driven by the lagging productivity of small firms, deserves more effective policy interventions due to its non-trivial implications on welfare and national development objectives. First, there is empirical evidence that manufacturing TFP directly influences economic growth as well as capital and labor productivity

[Jia et al. 2020]. Second, SMEs are important generators of new formal jobs in the developing world [Ayyagari et al. 2014]. The fact that small firms struggled to return to their pre-pandemic revenue, employment, and productivity levels will not only result in welfare losses but will also exacerbate the scarring effect of COVID-19. For a country that is aspiring to upgrade to the status of a rising industrial powerhouse, addressing these divergent productivity trends should be part of the post-pandemic growth strategy.

The METTRICS dataset used in this paper has unlocked new opportunities to study the post-pandemic experience of Philippine establishments. Future research can leverage its granularity to examine how regional and sectoral variations in lockdown policies shaped firm trajectories, highlighting differences in resilience across industries and locations.[10] By linking METTRICS with aggregate indicators such as mobility or local policy variables, causal analysis could further reveal the mechanisms driving recovery or stagnation of certain groups of firms. For instance, could unequal access to specific support programs during the pandemic have led to the productivity divergence between small and medium firms? Extending the METTRICS backwards will allow richer analysis of other global shocks such as trade wars and financial crisis.

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Appendices

APPENDIX 1. Description of variables used

Variable	Unit of measurement	Description
Value added output	Pesos (in 2018 prices)	Gross output less intermediate input
Labor	Persons	Total number of persons employed
Capital	Pesos (in 2018 prices)	Depreciation-adjusted book value of buildings, transport equipment, and machinery and equipment
Intermediate inputs	Pesos (in 2018 prices)	Costs of raw materials, electricity, and fuel
Industry GDP deflator	Index	Ratio of nominal to real value of the industry component of gross domestic product
Foreign ownership	Percent	Capital participation of foreign investors
Age	Years	Number of years since start of operation
Hours worked	Hours	Total hours spend by production workers at work
Average compensation	Pesos (in 2018 prices)	Total compensation expense/total employees
Capacity utilization rate	Percent	Ratio of total output to the maximum capacity of the establishment
Exporter	Dummy	1 if the establishment reported positive exports
Importer	Dummy	1 if the establishment reported positive imports
R&D spending	Dummy	1 if the establishment reported positive R&D expense
Access to finance	Dummy	1 if the establishment reported positive interest income from financial assets
Tangible investment	Dummy	1 if the establishment reported capital expenditures on machinery and equipment
Intangible investment	Dummy	1 if the establishment reported capital expenditures on intangible non-produced assets, computer software and databases, and R&D
Government subsidy	Dummy	1 if the establishment reported to have received subsidy, grant, aid, or financial assistance from government

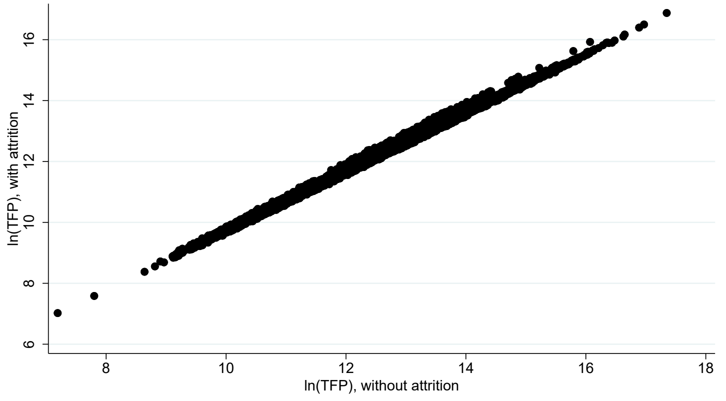
Note: All establishment-level variables are derived from the METTRICS dataset for 2019 to 2022.

APPENDIX 2. Summary statistics of variables used in the regressions

Variable		Mean	Std. dev.	Min	Max
TFP (ln)	overall	12.294	1.306	8.814	17.348
	between		1.244	8.814	16.964
	within		0.210	10.411	14.652
Foreign ownership (%)	overall	15.750	33.767	0	100
	between		27.861	0	100
	within		10.118	-59.225	90.750
Age (ln)	overall	2.654	0.905	0	5.130
	between		0.944	0	5.106
	within		0.191	-0.035	4.765
Hours worked (ln)	overall	11.156	2.027	0	17.891
	between		1.920	0	17.528
	within		0.354	3.690	15.221
Average compensation (ln)	overall	11.788	1.062	-0.693	17.860
	between		1.038	-0.693	17.340
	within		0.336	8.983	14.738
Capacity utilization rate	overall	74.571	19.013	1	100
	between		18.523	1	100
	within		8.599	8.571	122.071
Exporter (dummy)	overall	0.277	0.447	0	1
	between		0.384	0	1
	within		0.112	-0.473	1.027
Importer (dummy)	overall	0.246	0.431	0	1
	between		0.361	0	1
	within		0.060	-0.504	0.996
R&D spending (dummy)	overall	0.080	0.271	0	1
	between		0.209	0	1
	within		0.146	-0.670	0.830
Access to finance (dummy)	overall	0.317	0.465	0	1
	between		0.402	0	1
	within		0.174	-0.433	1.067
Tangible investment (dummy)	overall	0.246	0.431	0	1
	between		0.360	0	1
	within		0.223	-0.504	0.996
Intangible investment (dummy)	overall	0.033	0.180	0	1
	between		0.134	0	1
	within		0.104	-0.717	0.783
Government subsidy (dummy)	overall	0.016	0.126	0	1
	between		0.103	0	1
	within		0.072	-0.734	0.766

Source of raw data: PSA.
For all variables, N = 13349, n = 8453, T-bar = 1.579

APPENDIX 3. Scatter diagram of TFP estimates from the LP models with and without attrition



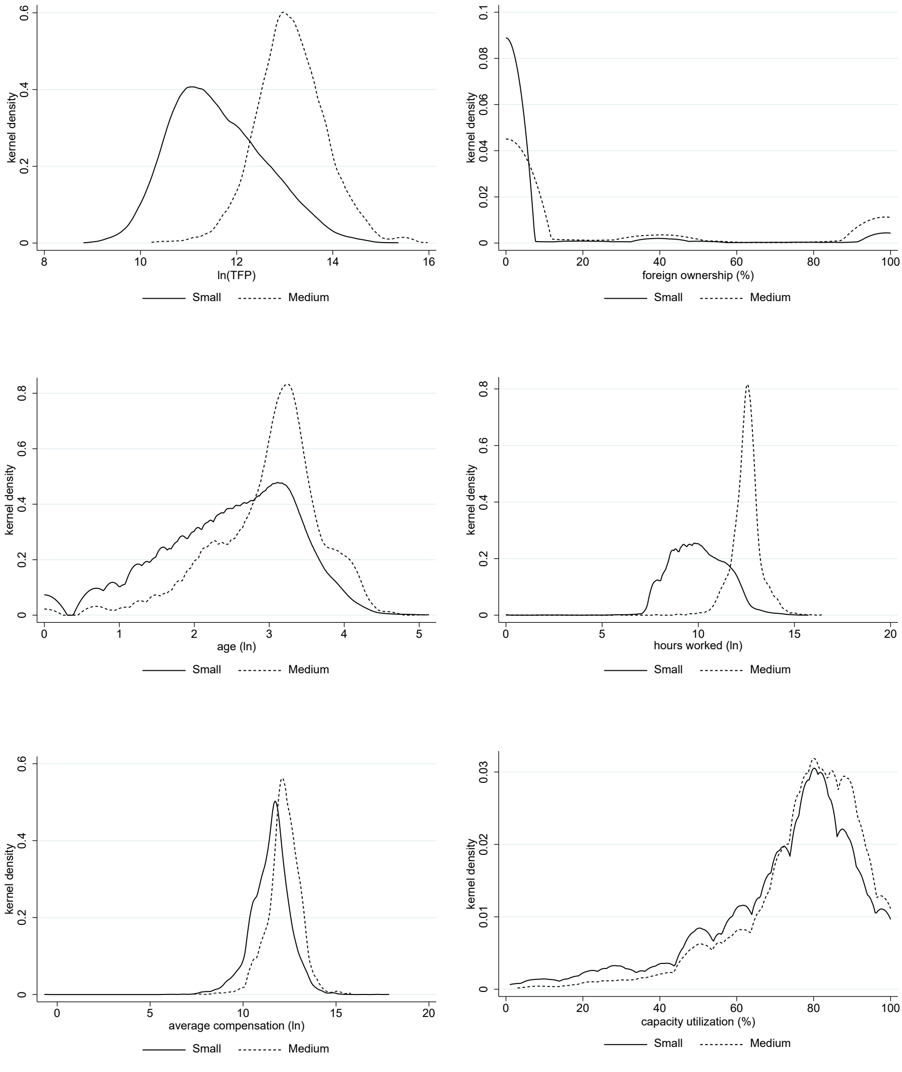
Source of raw data: PSA.

APPENDIX 4. Individual tests for weak instruments and exogeneity

	All manufacturers		SMEs	
	Cragg–Donald Wald *F*-statistic	**Endogeneity test χ^2**	**Cragg–Donald Wald *F*-statistic**	**Endogeneity test χ^2**
Foreign ownership (%)	56.270	1.289	27.436	0.377
Age (ln)	26.466	0.016	36.224	0.027
Total hours worked (ln)	71.419	0.001	43.215	1.820
Average compensation (ln)	71.191	0.339	14.768	0.332
Capacity utilization rate (%)	130.087	0.988	85.298	0.056
Exporter (dummy)	36.138	0.195	32.304	0.539
Importer (dummy)	38.792	0.120	18.117	0.766
R&D spending (dummy)	97.017	0.347	47.057	0.041
Access to finance (dummy)	122.778	0.025	71.081	0.461
Tangible investment (dummy)	181.896	0.174	82.216	0.196
Intangible investment (dummy)	195.924	0.850	144.764	0.015
Government subsidy (dummy)	147.021	0.396	90.992	0.274

• The Cragg–Donald Wald *F*-statistics are above the Stock and Yogo 10 percent maximal IV size critical value of 16.38, rejecting the null hypothesis of weak instruments. For average compensation (ln) in the SMEs subsample, the Cragg–Donald Wald F-statistic is greater than the 15 percent maximal IV size critical value of 8.96 and the Staigler-Stock threshold of 10.
• At 5 percent level of significance, the endogeneity test cannot reject the null hypothesis that the regressor being tested is exogenous.

APPENDIX 5. Kernel densities of small and medium-sized firms across various characteristics



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Perceived comfort and subjective life evaluation in the Philippines: Evidence from a national visioning exercise

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This study examines how Filipinos evaluate their current life status and determines the factors associated with achieving a "comfortable life", utilizing data from the National Economic and Development Authority's (NEDA) Long-Term Vision exercise (*AmBisyon Natin* 2040). Instead of measuring subjective well-being in the conventional sense of happiness or life satisfaction, this research interprets respondents' self-assessed comfort levels—categorized as "poor," "sometimes poor and sometimes comfortable," or "at least comfortable"—as indicators of perceived material security and life adequacy. Using a generalized ordered logistic model, the results demonstrate that income, livelihood, and education are critical drivers of achieving at least a comfortable life. Similarly, satisfaction with health, education, and community environment also increases the likelihood of reporting comfort. The findings provide insights into the socio-economic and environmental correlates of Filipinos' perceived quality of life, as articulated through this national visioning exercise.

JEL classification: I31, O15, D60, C25.
Keywords: Comfort, subjective life evaluation, quality of life, long-term visioning, Philippines

1. Introduction

Traditional metrics such as Gross Domestic Product (GDP) and poverty incidence measure the objective aspects of living conditions but fail to capture how citizens perceive their current life situation. The *AmBisyon Natin 2040* survey, conducted by the National Economic and Development Authority (NEDA),[1] was designed as a long-term visioning exercise to understand the

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[1] NEDA was recently renamed Department of Economy, Planning, and Development (DEPDev)

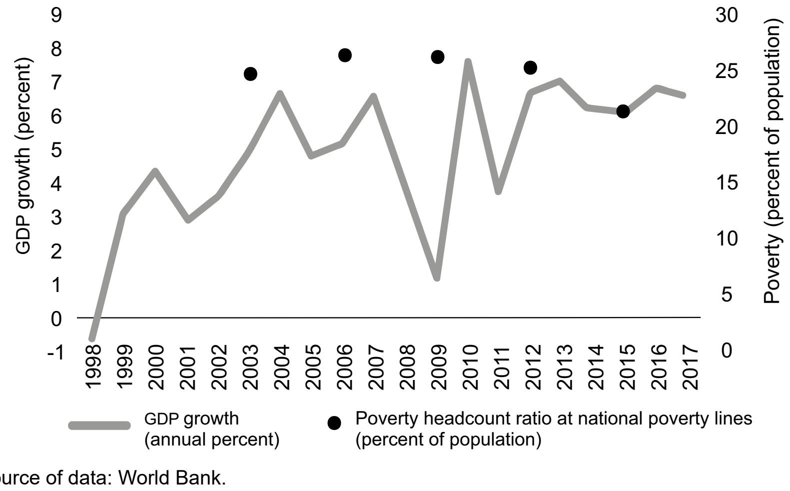
aspirations of Filipinos by 2040 and their views on present circumstances relative to that vision. While not explicitly a survey of happiness or life satisfaction, it presents a unique opportunity to analyze subjective life evaluation—specifically, how people describe their current life as "poor," "sometimes poor and sometimes comfortable," or "at least comfortable."

This notion of comfort reflects material adequacy and security rather than emotional (hedonic) or eudaimonic well-being, providing a valuable perspective on how Filipinos assess their quality of life within their socio-economic context.

The Philippines recorded high levels of economic growth, as measured by its GDP, over the decade preceding the COVID-19 pandemic (Figure 1). However, the government has faced criticism for the limited impact on poverty, which remained above 20 percent, despite an average of 5.6 percent GDP growth between 2008 and 2017. This suggests that GDP growth does not automatically translate to poverty alleviation or improved living conditions for Filipinos.

Compounding this, despite at least 20 percent of Filipinos remaining poor, the country has consistently ranked high in global happiness surveys, such as being the third happiest country in the world based on the 41st Annual Global End of Year Survey of Gallup International [Placido 2018]. During the same period, a self-rated poverty survey showed that 44 percent of Filipino families considered themselves "poor" [SWS 2018]. These survey results highlight that Filipinos can still report happiness despite socioeconomic hardships.

FIGURE 1. Gross Domestic Product (1998-2017) and Poverty Incidence (2003-2015)



Source of data: World Bank.

Given these seemingly paradoxical stylized facts, this paper investigates how Filipinos evaluate their current life or comfort level and identifies the significant factors that affect comfort. Using the nationally representative Long-term Vision dataset from NEDA, this paper employs *a generalized ordered logistic regression* *model* to evaluate which factors determine the probability that an individual considers his or her life as "poor", "sometimes poor or sometimes comfortable", or "at least comfortable." The factors that affect the subjective life evaluation of Filipinos include those that relate to personal capabilities (i.e., *income and livelihood*) and the quality of institutions (e.g., *public office and services*).

2. Conceptual background and related literature on subjective life evaluation and perceived comfort

Well-being is an ambiguous, multi-faceted concept that lacks a universally accepted definition. Historically, it was often associated with or assessed by measurable economic indicators like GDP per capita. Dissatisfaction with purely income-based measures led to an evolution toward a more multidimensional approach, including frameworks based on capabilities and *functionings* [Sen 1987; 1999], central human capabilities [Nussbaum 1987], intermediate human needs [Doyal and Gough 1991], and axiological needs [Narayan et al. 2000]. Easterlin [2004] treated happiness and life satisfaction as interchangeable measures of overall feelings of well-being. As a result, well-being has been used to refer to terms like quality of life, welfare, living standards, utility, life satisfaction, prosperity, human development, and even happiness.

The recognition of the shortcoming of GDP as an objective measure of well-being by Easterlin [1974] spurred the use of non-economic indicators, such as education, health, environment, and empowerment [Conceicao and Bandura 2008], or adjusted GDP by monetizing social indicators and environmental factors [McGillivray 2007]. These improvements, however, are also limited by issues surrounding quantifying or monetizing factors (e.g., value of leisure, damage of pollution, etc.) and oversimplification using indices.

Recognizing the limitations of objective well-being indicators, Subjective Well-Being (SWB) measures have been introduced to capture "*a multidimensional evaluation of life, including cognitive judgments of life satisfaction and affective evaluations of emotions and moods*" [McGillivray and Clarke 2006]. Yet SWB itself presents conceptual challenges. Economists interchangeably use the terms "happiness" and "life satisfaction" with SWB [Easterlin 2004], although others characterize subjective well-being as "being happy" (*eudaimonia*) while "satisfaction" and "happiness" as "feeling happy" (*hedonic*) [Bruni and Porta 2007]. The Organisation for Economic Cooperation and Development (OECD) defines SWB more broadly as "*good mental states, including all of the various evaluation, positive and negative, that people make of their lives and the affective reactions of people to their experiences*" [OECD 2013]. This definition encompasses three elements: *life evaluation*, a reflective assessment on a person's life or its specific aspects; *affect*, referring to emotional states at a point in time; and *eudaimonia*, a sense of meaning, purpose, and psychological functioning.

Economic determinants of life evaluation and perceived comfort include income, employment, and inflation. However, Easterlin [1974] argued in various studies that increasing income does not necessarily make people happier, arguing that people should devote less time in making money and more time for nonpecuniary goals such as family life and health. Dynan and Ravina [2007] found that happiness is based on relative, rather than absolute, income and adapts to changes in income over time. Graham and Pettinato [2002] further observed that happiness may be affected by volatility in income flows, while Di Tella and MacCulloch [2006] demonstrated that social welfare is reduced by higher inflation and unemployment rates. Unemployment, in particular, entails not only pecuniary losses but also diminished self-esteem, depression, anxiety, and social stigma, while inflation erodes purchasing power.

Non-economic determinants of happiness can be grouped into socio-demographic and institutional factors. Happiness has a U-shaped relationship with age [Blanchflower and Oswald 2007], while health status declines throughout the life cycle which has lasting negative effect on happiness [Easterlin 2003; 2004]. Marriage has been shown to increase happiness by providing companionship and mutual support (Stutzer and Frey [2006]; Helliwell [2003]). Behera et al. [2024] examined subjective well-being across 166 countries and showed that social support positively impacts happiness. Shams [2014] reported that education and health positively affect subjective well-being in rural Pakistan.

Institutional factors, including political, economic, and personal freedoms also shape well-being. Frey and Stutzer [2002] argued that individuals report higher well-being in settings with developed institutions and decentralized government, while Veenhoven [2000] identified a positive link between national freedom and happiness. Pontarollo et al. [2020] found that women and indigenous people in Ecuador experience lower well-being, though improvements in education, housing quality, institutional trust, and health insurance mitigate these gaps.

This study contributes to this literature by examining the case of the Philippines, one of the fastest growing developing countries in the period 2010 to 2016, with average GDP growth of 6.4 percent. Yet, as noted earlier, economic growth does not automatically enhance perceived well-being. This paradox—where rising incomes coexist with persistent dissatisfaction—has gained prominence in research on well-being. While much of the literature focuses on advanced economies, fewer studies investigate how individuals in developing countries interpret their economic circumstances amid inequality, informality, and vulnerability. The Philippines provides a particularly relevant case: despite sustained economic expansion and poverty reduction, many Filipinos continue to report feeling economically insecure or “sometimes poor.” Previous empirical studies on happiness and comfort in the Philippines were of limited scope, focusing on narrow subpopulations such as children of farmers [Tolentino and Dullas 2015] or high school students [Galang et al. 2011].

By contrast, this study examines the determinants of perceived comfort, as captured by self-assessed financial status, using nationally representative data from the Philippines. By focusing on the divergence between objective improvements in income and subjective perceptions of economic comfort, this paper contributes to understanding the mechanisms behind the well-being paradox in a developing-country setting.

In this study, the term perceived economic well-being or comfort is not treated as a direct synonym for happiness or SWB as defined in OECD [2013] or Diener et al. [1985]. Instead, it is understood as a measure of self-assessed material sufficiency—a sense of being able to meet basic needs and live with relative ease and stability. This framing aligns with the design and intent of the AmBisyon Natin 2040 aspiration for a "matatag, maginhawa, at panatag na buhay" (stable, comfortable, and secure life). Comfort is thus treated as a component of perceived quality of life: related to subjective well-being, but more grounded in tangible, resource-based evaluations.

To assess the drivers of perceived economic comfort, the study utilizes nationally representative household data and estimates models linking self-assessed economic status with objective and contextual factors. This framework allows us to test whether perceived economic well-being aligns with objective indicators of welfare or whether structural, institutional, and socio-demographic factors drive the observed divergence. By combining subjective and objective measures within a unified empirical framework, the study offers new evidence on the drivers of subjective life evaluation and the persistence of the economic growth-life satisfaction paradox in the Philippines.

3. Data and methods

3.1. The NEDA Long-Term Vision (LTV) project

The analysis draws on data from the *AmBisyon Natin* 2040 or Long-Term Vision (LTV) project of NEDA, which surveyed 10,000 respondents nationwide in early 2016, selected through a multi-stage area probability sampling.[2] Although the survey's primary purpose was to articulate Filipinos' aspirations for the future, it also included questions on respondents' assessment of their current circumstances—whether they consider themselves "poor," "sometimes

[2] While the LTV survey was designed to be nationally representative of Filipino adults through multi-stage area probability sampling, minor deviations from official demographic distributions are expected. For instance, the share of respondents with a college degree in the sample (about 10 percent) is slightly lower than the 2015 Census estimate of roughly 11 percent. These differences may stem from (i) variations in timing and coverage between the 2015 Census and the early 2016 fieldwork of the LTV survey and/or (ii) minor precision limitations inherent in the sampling design. Addressing this issue is beyond the scope of the present paper.

poor and sometimes comfortable," "comfortable," or "more than comfortable." While this item was not designed as a formal measure of subjective well-being, it functions as an indicator of self-evaluated comfort and perceived material and socio-economic adequacy. Accordingly, the dependent variable in this study is interpreted as a form of subjective life evaluation, distinct from a conventional measure of happiness or life satisfaction.

The questionnaire has two major sections covering respondents' future vision and present situation, with questions on general life, standard of living, health, education, employment, urbanization, economy, justice and governance, peace and security, and cultural diversity.

Regarding current life evaluation, 64 percent of respondents described their current life status as "sometimes poor, sometimes comfortable," while 24 percent reported being "comfortable", and 11 percent identified as "poor". This distribution is generally consistentt across income classes, except among Class AB, where a majority (56 percent) reported living comfortably or more than comfortably.

In terms of education, 90 percent of respondents did not have a college degree, 31 percent completed high school only, and 14.2 percent attended, but did not finish, college. Across educational attainment groups, most respondents still described their lives as "sometimes poor and sometimes comfortable," except for those who had attended or completed graduate studies—about half of whom assessed their lives as comfortable or more than comfortable.

More male respondents (11.5 percent) reported being poor than female respondents (10.5 percent). However, slightly more female respondents (64.8 percent) said that their life is sometimes comfortable and sometimes poor. More urban dwellers (27.3 percent) assessed their life as comfortable or more than comfortable compared to those living in rural areas (23.7 percent). A higher proportion of respondents aged 20 years and below (27.6 percent) rated their lives as comfortable or more than comfortable, compared to respondents aged 21 to 40 years.

Current life evaluation also varied by livelihood. Comfort levels were highest among those who managed their own business or were students (around 30 percent), and lowest among part-time workers (18.4 percent). Extended households reported higher level of current life evaluation (29 percent) saying that their life is comfortable or more than comfortable relative to nuclear households (24.2 percent). Additional sources of income improved comfort perception: 34.3 percent of respondents who received remittance in the past 12 months described their life as comfortable or more than comfortable, compared with 24.2 percent among non-recipients. The number of employed household members also affects the respondents' life evaluation. Only 23.7 percent of the respondents with one employed household member rated their life comfortable or more than comfortable. This level increased to 27 percent for those with two employed household members, 28.9 percent for those with three employed household members, and 37.9 percent for those with four employed household members.

TABLE 1. Weighted proportions of Filipinos' current life evaluation by income class, education, gender, region, work status, and household characteristics

	Weighted proportion in sample	Poor	Sometimes poor/ comfortable	Comfortable	More than comfortable	Sample *N*
SAMPLE		11.0	63.7	23.9	1.3	
AB	0.6	1.7	42.3	47.0	9.0	60
C1	4.8	2.9	50.4	45.1	1.7	493
C2	17.2	5.0	58.7	34.6	1.7	1,727
D	48.2	9.0	67.9	21.8	1.3	4,784
E	29.2	19.3	62.5	17.2	1.1	2,936
Education						
No formal education	0.1	16.3	83.7	0.0	0.0	6
Some Elementary	7.5	23.6	59.6	15.8	1.1	681
Completed Elementary	10.1	18.5	63.1	17.7	0.7	922
Some High school	17.0	15.1	66.3	16.5	2.1	1,495
Completed High school	35.6	9.3	67.8	21.8	1.1	3,198
Some College	16.4	7.1	63.1	28.4	1.4	1,467
Completed College	10.4	4.7	56.4	37.5	1.4	958
Some Graduate/ Masters	0.1	0.0	56.0	44.0	0.0	9
Completed Graduate/Masters	0.1	0.0	44.7	47.5	7.9	11
Vocational/ Technical	2.7	7.1	68.7	23.0	1.2	238
Sex						
Male	50.3	11.5	62.7	24.5	1.3	5,002
Female	49.7	10.5	64.8	23.4	1.4	4,998
Age						
<20	23.1	9.3	63.1	25.7	1.9	1,827
21-30	31.7	9.8	65.2	23.8	1.3	3,076

TABLE 1. Weighted proportions of Filipinos' current life evaluation (continued)

	Weighted proportion in sample	Poor	Sometimes poor/ comfortable	Comfortable	More than comfortable	Sample *N*
31-40	25.4	12.8	63.7	22.6	1.0	2,897
41-50	19.8	12.7	62.1	23.9	1.3	2,200
Region						
NCR	12.4	10.3	60.7	28.3	0.7	1,280
CAR	1.8	12.1	48.7	36.8	2.4	170
Ilocos	5.0	8.9	69.8	19.1	2.1	500
Cagayan	3.4	10.8	70.4	16.5	2.2	340
Central Luzon	10.9	15.0	66.7	17.4	0.9	1,110
Calabarzon	13.9	10.6	73.6	15.1	0.8	1,450
Mimaropa	3.1	11.3	73.2	14.9	0.7	290
Bicol	6.0	11.4	70.5	17.2	1.0	570
Western Visayas	8.9	10.7	53.7	32.6	2.9	890
Central Visayas	6.0	3.1	53.0	41.8	2.1	589
Eastern Visayas	4.5	9.7	54.2	35.4	0.6	431
Zamboanga	3.7	24.6	40.4	32.3	2.6	370
Northern Mindanao	4.6	13.0	66.6	19.2	1.2	470
Davao	4.9	10.6	73.2	15.0	1.2	480
Soccsksargen	4.5	8.2	57.4	33.6	0.7	460
Caraga	2.7	10.5	70.8	18.4	0.4	260
ARMM	3.7	7.7	65.1	25.2	2.0	340
Urbanity						
Rural	54.3	11.3	65.1	22.3	1.4	5,380
Urban	45.7	10.7	62.1	26.0	1.3	4,620

TABLE 1. Weighted proportions of Filipinos' current life evaluation (continued)

	Weighted proportion in sample	Poor	Sometimes poor/ comfortable	Comfortable	More than comfortable	Sample *N*
Work status						
Working/ Employed in a company	27.8	11.1	63.0	24.7	1.2	2,930
Manages/ maintains own business	10.5	8.0	60.2	30.1	1.8	1,133
Working part-time	8.2	17.8	63.9	17.2	1.2	864
Not working	40.4	11.2	66.7	20.8	1.3	4,058
Studying	13.1	8.2	58.8	31.4	1.7	1,015
Household type						
Single/Nuclear Family	98.1	11.0	63.8	23.9	1.3	9,819
Extended/with non-relatives	1.9	8.2	62.8	26.0	3.0	181
Number of employed in the household						
1	61.9	13.1	63.2	22.5	1.2	6,235
2	29.2	7.9	65.2	25.6	1.4	2,908
3	6.7	7.0	64.0	27.4	1.5	646
4	1.6	4.1	58.0	33.7	4.2	150
5	0.6	6.9	57.8	29.8	5.5	55
6	0.1	0.0	84.4	0.0	15.6	6
Received remittance in the past 12 months						
No	89.4	11.8	64.0	22.9	1.3	8,960
Yes	10.6	4.1	61.6	32.4	1.9	1,040

Source: Authors' calculations, based on the data from the Long-Term Vision (LTV) project (also known as AmBisyon Natin 2040 project) of the National Economic and Development Authority (NEDA). Note: We excluded from the sample those with missing information for a particular question.

For this study, only questions that evaluate certain life domains (e.g., education, health, etc.) were included for generating indices. Moreover, response options to some questions in the survey instrument have a five-point scale, while others have a seven-point scale or even a three-point scale. For instance, the response options to the question that asked respondents whether they are afraid that they will not be able to give their family their everyday needs are in the following four-point scale: (1) definitely disagree, (2) somewhat disagree, (3) somewhat agree, and (4) definitely agree. In order to make the scales uniform, responses were reduced to only two options to reflect either negative or positive evaluation on a certain subject or life domain.

The ordinal responses to the included questions were also recoded to reflect uniform direction. For instance, the previously mentioned question that asked respondents whether they are afraid that they will not be able to give their family their everyday needs, the scale was reversed to make the responses reflect (1) negative to (2) positive direction of the responses.

3.2. Methods

This study uses respondents' current life evaluation as a proxy for perceived comfort or material well-being, in contrast with hedonic or eudaimonic measures of subjective well-being. The original four categories—*poor*, *sometimes poor and sometimes comfortable*, *comfortable*, and *more than comfortable*—were collapsed into three by creating the "at least comfortable" (n = 2,487) category which combined the "more than comfortable" (n = 128) and "comfortable" (n = 2,359) categories. This prevents sparse categories that may produce negative predicted probabilities in ordered responses [Williams 2016]. The resulting dependent variable thus consists of (1) poor, (2) sometimes poor, sometimes comfortable, and (3) at least comfortable.

Given the ordinal dependent variable, an ordered logistic regression model is first considered [Liu and Koirala 2012]:

$$ln(Y_j') = ln\left(\frac{\pi(x)}{1-\pi(x)}\right) \qquad (1)$$
$$= \alpha_j + (-\beta_1 X_1 - \beta_2 X_2 - \ldots - \beta_p X_p)$$

where $\pi_j(x) = \pi(Y \leq j \mid x_1, x_2, \ldots, x_p)$ refers to the probability of being at or below category j, given the set of predictors, j =1,2, …, J-1, while α_j are the cut-off points and β_1, β_2,… β_p are the logit coefficients. For j number of categories, the Proportional Odds (PO) model estimates J-1 cut-off points.

However, the PO assumption of the ordered logit model is strict and often violated. Violations may occur due to the large number of explanatory variables [Brant 1990], large sample size [Clogg and Shihadeh 1994], or inclusion of continuous covariates

[Allison 2012].[3] To remedy this, we resort to an alternative parameterization of the model. Specifically, we fit the partial proportional odds (PPO) model or the generalized ordinal logit model using the command gologit2 in Stata.

The generalized ordinal logistic regression model is an extension of the PO model by relaxing the PO assumption for some or all the predictor variables [Liu 2016]. As proposed by Fu [1998] and Williams [2006], this model can be expressed as follows:

$$logit\ [\pi(Y > j \mid x_1, x_2, \ldots, x_p) = ln \left(\frac{\pi(Y > j \mid x_1, x_2, \ldots, x_p)}{\pi(Y \leq j \mid x_1, x_2, \ldots, x_p)} \right)$$
$$= \alpha_j + (\beta_{1j} X_1 + \beta_{2j} X_2 + \ldots + \beta_{pj} X_p)$$

where α_j refers to the intercepts or cut-off points, while $\beta_{1j}, \beta_{2j}, \ldots \beta_{pj}$ are the logit coefficients of the predictor variable $X_1, X_2, \ldots X_p$, respectively [Liu 2016].

This alternative model relaxes the PO assumption and allows the effects of the explanatory variables to vary with the point at which the categories of the dependent variables are dichotomized [Williams 2005]. When only some predictor variables violate the PO assumption in the ordered logit model, the partial proportionate odds framework allows these variables to vary across the different thresholds while keeping the others constrained.

In contrast with the PO model, which estimates the probability of being at or below category j, the PPO model estimates the probability of being beyond category j versus being at or below it. The logit coefficient (β) is interpreted as the change in log-odds of being beyond a category, while the odds ratio (OR) represents multiplicative change in those odds.

For this study, the generalized ordinal logit model was used to estimate the effects of "life domains" on Filipinos' overall life evaluation.[4] We include six life domain indices constructed from survey questions manually grouped into thematic domains: constraints/worries, education, employment, health, peace, or governance. Table 2 lists the questions grouped per life evaluation domain.

Each life evaluation domain k is summarized as:

$$I^k = \frac{\sum_{j=1}^{n} X_j^k}{\sum_{j=1}^{n} X_{max,j}^k},$$

where: X_j is the actual score of the respondent for each question j
X_{max} is the maximum score for each question j

[3] The brant command in Stata, as proposed by Brant [1990] was used to test the proportional odds assumption. A significant test statistic means that the parallel odds assumption has been violated.

[4] We also estimate alternative specifications using a generalized ordinal logit model applied to (1) evaluations of life, community, government, and country; (2) a set of factors derived from factor analysis reflecting perceptions, trust, and satisfaction with governance; and (3) a set of components generated through principal component analysis (PCA). The full results are available from the authors upon request.

Control variables include income class, education, gender, island group (i.e., Luzon, Visayas, or Mindanao), location (i.e., rural or urban), work status, household type, number of employed household members, number of household members, and whether the household received remittances in the past 12 months.

TABLE 2. Groupings of questions according to life evaluation domains

Life evaluation domain		Questions
Worry-free Life (Constraints)	1	I am NOT afraid that my family will lose our house [1 – Disagree, 2 - Agree]
	2	I am NOT afraid that I or my family will lose our source of income [1 – Disagree, 2 - Agree]
	3	I am NOT afraid that I will not be able to give my family their everyday needs [1 – Disagree, 2 - Agree]
	4	In everyday occurrences, please tell me if you have worries about having a job or source of income. [1 - Worried, 2 - Not worried]
Education	1	Satisfaction on Technical or Vocational school [1 - Not satisfied, 2 -So satisfied]
	2	Satisfaction on Private University [1 - Not satisfied, 2 -So satisfied]
	3	Satisfaction on Public University [1 - Not satisfied, 2 -So satisfied]
	4	Satisfaction on Private High School [1 - Not satisfied, 2 -So satisfied]
	5	Satisfaction on Private Elementary Schools [1 - Not satisfied, 2 -So satisfied]
	6	Satisfaction on Public HS [1 - Not satisfied, 2 -So satisfied]
	7	Satisfaction on Public Elementary [1 - Not satisfied, 2 -So satisfied]
Employment	1	Do you believe that you have many or few opportunities or chances to get a decent job or business? [1 – None, 2 - Many]
	2	In this time, everyone will be able to find a job if they want to. [1 – Disagree, 2 - Agree]
	3	It is good for the country, in the next 25 years, if the citizens will stay in the country instead of going abroad to work. [1 – Disagree, 2 - Agree]
	4	When the year 2040 comes, everyone who wants to work should be able to find a decent job [1 – Disagree, 2 - Agree])
Health	1	Are you not satisfied, somewhat satisfied, satisfied or very satisfied with the private hospitals? [1 - Not satisfied, 2 -So satisfied]

TABLE 2. Groupings of questions according to life evaluation domains (continued)

Life evaluation domain		Questions
	2	Are you not satisfied, somewhat satisfied, satisfied or very satisfied with the public health center employees? [1 - Not satisfied, 2 -So satisfied]
	3	Are you not satisfied, somewhat satisfied, satisfied or very satisfied with the public hospital employees? [1 - Not satisfied, 2 -So satisfied]
	4	Are you not satisfied, somewhat satisfied, satisfied or very satisfied with the public health centers? [1 - Not satisfied, 2 -So satisfied]
	5	Are you not satisfied, somewhat satisfied, satisfied or very satisfied with the public hospitals? [1 - Not satisfied, 2 -So satisfied]
	6	When 2040 comes, my health is well until I grow old. [1 - Not confident, 2 - Confident]

The inclusion of subjective variables such as satisfaction, perceptions, and confidence is consistent with established approaches in the well-being and quality-of-life literature, where both objective and subjective dimensions jointly shape individuals' life evaluation (Diener et al. [1985]; Frey and Stutzer [2002]; OECD [2013]). These measures capture qualitative aspects of people's lived experience—trust in institutions, satisfaction with services, or feelings of safety—that objective indicators alone cannot represent. In the context of the AmBisyon Natin 2040 survey, these variables are particularly relevant because the exercise was designed to elicit how Filipinos perceive their current life and environment relative to their aspirations for a "matatag, maginhawa, at panatag na buhay." Hence, the inclusion of subjective explanatory factors is not intended to imply causality but to account for perceived institutional and community conditions that co-vary with respondents' self-assessed comfort or life evaluation. This approach is consistent with prior empirical work treating subjective perceptions as proximate determinants of well-being evaluations rather than as outcomes (Boarini et al. [2012]; Ngoo, Tey, and Tan [2015]).

4. Results and discussion

Table 3 presents the mean values of the indices for each category of the covariates. For instance, individuals with college degrees express relatively higher evaluations about the quality of the education in the country (μ = 0.93), employment conditions (μ = 0.92), health services (μ = 0.93), peace and security (μ = 0.64), community environment (μ = 0.65), and governance (μ = 0.76), compared to those without a college degree.

TABLE 3. Mean values of indices on education, employment, health, security, and governance evaluations

COVARIATES	Education	Employment	Health	Peace and security	Safe community	Governance
Education						
With college degree (n=853)	0.93	0.92	0.93	0.64	0.65	0.76
Without college degree (n=7,718)	0.88	0.91	0.92	0.63	0.60	0.75
Gender						
Male (n=4,116)	0.88	0.90	0.92	0.63	0.61	0.75
Female (n=4,455)	0.89	0.91	0.92	0.63	0.61	0.75
Location						
Luzon (n=4,670)	0.86	0.92	0.91	0.65	0.62	0.73
Visayas (n=1,823)	0.93	0.90	0.94	0.61	0.60	0.76
Mindanao (n=2,078)	0.92	0.90	0.92	0.60	0.59	0.79
Urban (n=3,688)	0.89	0.91	0.92	0.63	0.62	0.74
Rural (n=4,883)	0.88	0.91	0.92	0.63	0.60	0.76
Age (ave=31)						
<31 (n=4,152)	0.89	0.91	0.92	0.63	0.61	0.76
31 (n=238)	0.89	0.92	0.93	0.63	0.60	0.75
>31 (n=4,181)	0.89	0.91	0.92	0.63	0.61	0.76
Work status						
Working/employed in a company (n=2,471)	0.89	0.91	0.92	0.63	0.61	0.75
Own business (n=951)	0.90	0.92	0.92	0.63	0.62	0.74
Part-time work (n=752)	0.86	0.88	0.91	0.62	0.58	0.76
Studying (n=825)	0.90	0.91	0.92	0.63	0.62	0.76

TABLE 3. Mean values of indices on education, employment, health, security, and governance evaluations (continued)

COVARIATES	Education	Employment	Health	Peace and security	Safe community	Governance
Household characteristics						
Living with extended family members (n=144)	0.93	0.91	0.94	0.64	0.63	0.77
Living with nuclear family (n=8,427)	0.89	0.91	0.92	0.63	0.61	0.75
Number of household members (ave=1.32)						
<2 (n=6,623)	0.88	0.91	0.92	0.63	0.61	0.75
2 (n=1,364)	0.89	0.91	0.92	0.64	0.62	0.73
>2 (n=584)	0.90	0.91	0.92	0.63	0.61	0.74
Number of employed household members (ave=1.44)						
<2 (n=5,443)	0.88	0.90	0.92	0.63	0.60	0.75
2 (n=2,433)	0.89	0.92	0.92	0.64	0.62	0.74
>2 (n=695)	0.90	0.92	0.92	0.64	0.62	0.86
Received remittance						
Yes (n=863)	0.92	0.93	0.92	0.64	0.63	0.74
No (n=7,708)	0.88	0.91	0.92	0.63	0.61	0.75

Our specification has a chi2(10) of 11.26, and *p-value* of 0.3373, which is not significant—indicating that proportional odds assumptions for the entire model are upheld.[5] The estimates for our model are shown in Table 4.

Personal characteristics and capability. Gender and age have significant impacts on subjective life evaluation. The odds of assessing life as "more than comfortable" are 15.29 percent higher for males (β^{spc}_{male}= 0.14 | OR^{spc}_{male}= 1.15) than the odds for females. On the other hand, a unit increase in actual age decreases the odds of being "not poor" (i.e., sometimes poor or comfortable or better) by 1.22 percent (β^{p}_{age}= -0.01 | OR^{p}_{age} = 0.99). However, since the odds ratio is nearly equal to 1, the practical significance of age is minimal.

Livelihood and sources of income for the family, as well as the ability to work and earn income, significantly shape life evaluations. Compared to those in Income Class E, individuals in higher income classes have higher likelihood of evaluating life as "more than comfortable." The odds for Class D to evaluate life as "more than comfortable" is 29.66 percent higher (β^{spc}_{D} = 0.26 | OR^{spc}_{D}= 1.30) than the odds for the respondents in Income Class E. These odds are 165.22 percent higher for those in Income Class C2 (β^{*}_{C2}= 0.98 | OR^{*}_{C2} = 2.65), 361.22 percent higher for those in Income Class C1 (β^{*}_{C1}= 1.53 | OR^{*}_{C1}= 4.61), and 373.59 percent higher for the highest Income Class AB (β^{spc}_{AB} = 1.56 | OR^{spc}_{AB} = 4.74).

Household characteristics also matter. An additional household member also increases the odds of evaluating life as "not poor" by 6.61 percent ($\beta^{*}_{HHmember}$ = 0.06 | $OR^{*}_{HHmember}$ = 1.07). The results show that the odds of being "not poor" is 31.40 percent higher for an additional number of employed household member ($\beta^{p}_{employedHH}$ = 0.27 | $OR^{p}_{employedHH}$ = 1.31).

Educational attainment exhibits one of the strongest capability effects. Having at least a college degree increases the odds of assessing life as "more than comfortable" by 48.80 percent ($\beta^{*}_{college}$ = 0.40 | $OR^{*}_{college}$ = 1.49), while simply studying increases the odds of evaluating life as "more than comfortable" by 50.88 percent ($\beta^{spc}_{studying}$ = 0.41 | $OR^{spc}_{studying}$ = 1.51). This aligns with the widespread perception of a college diploma as a pathway to employment and financial stability—an interpretation supported by the finding that livelihood positively impacts people's overall life evaluation.

Employment-related perceptions also play a critical role. The odds of evaluating life as "more than comfortable" are 230.45 percent higher for those with more positive assessment about job opportunities in the country ($\beta^{*}_{employment}$ = 1.20 | $OR^{*}_{employment}$ = 3.30). Managing a business increases these odds by 43.03 percent higher ($\beta^{*}_{own\ business}$ = 0.36 | $OR^{*}_{own\ business}$ = 1.43) relative to being unemployed.

[5] In this specification, nine of the 22 predictor variables meet the PO assumption. These are the indices on health, worry-free life (*constraints index*), income class (C1 and C2), college education, work status (being employed, managing own business, and working part-time), as well as various household characteristics (number of household members). For the rest of the predictor variables, the PO assumption was relaxed; hence, their coefficients were allowed to vary within the model specification comparing the outcome categories.

TABLE 4. Life domains and perception of comfort/life evaluation (N=8,558)

COVARIATES	Poor		Sometimes poor or comfortable	
	Coefficient	Odds ratio	Coefficient	Odds ratio
Life Domains				
Education	1.487894***	4.427759	0.7698443***	2.15943
Employment	3.258179***	26.00213	1.195296***	3.304535
Health	0.4637151***	1.58997	0.4637151***	1.58997
Worry-free life (constraints)	0.9564755***	2.602508	0.9564755***	2.602508
Income class (*base=E*)				
AB	13.72428***	912,804.8	1.555171***	4.735897
C1	1.528703***	4.61219	1.528703***	4.61219
C2	0.9753907***	2.652203	0.9753907***	2.652203
D	0.658909***	1.932683	0.2597569***	1.296615
College education	0.397419***	1.487979	0.397419***	1.487979
Location (*base=Luzon*)				
Visayas	0.5537393***	1.739746	1.165063***	3.206125
Mindanao	0.0741606	1.07698	0.4792491***	1.614861
Urban	-0.2800915***	0.7557146	0.0099031	1.009952
Gender (male)	-0. 0708487	0.9316028	0.1422558***	1.152872
Actual age	-0.0122906***	0.9877847	0.0037926	1.0038
Work status (*base=unemployed*)				
Working/Employed in a company	0.0709391	1.073516	0.0709391	1.073516
Own business	0.3578566***	1.430261	0.3578566***	1.430261
Part-time work	-0.0892997	0.9145715	-0.0892997	0.9145715
Studying	-0.0649013	0.9371599	0.4112886***	1.508761
Household characteristics				
Living with extended family members	0.0677156	1.070061	0.0677156	1.070061
Number of household members	0.0640152*	1.066109	0.0640152*	1.066109
Number of employed household members	0.2730789***	1.314004	0.0610315	1.062932
Received remittance	0.63095***	1.879395	0.1728738**	1.188716
Constant	-3.706932***	.0245527	-5.270879***	0.0051391

Notes:
1. *p-value ≤0.1, **p-value ≤0.05, and *** p-value ≤ 0.01
2. The covariates in boldface that have the same coefficients regardless of the outcome category (i.e. poor and sometimes poor or comfortable) upheld the PO assumption.
3. The covariates with different coefficients for each outcome category violated the PO assumption. The PPO model relaxes this assumption.

Having the ability to earn additional income for the household also influences people's life assessment, as the odds are 18.87 percent higher for those who received remittances ($\beta^{*}_{remittance}$ = 0.17 | $OR^{*}_{remittance}$ = 1.19) than those who did not receive remittances in the past 12 months.

Beyond material capability, psychological and emotional security matter. Those who report living a "worry-free life" have 160.25 percent higher odds of assessing life as affluent ($\beta^{*}_{constraints}$ = 0.96 | $OR^{*}_{constraints}$ = 2.60) than those who do not feel secure in providing their family's needs.

Environment, community, and society. The quality of environment and locality where people live also influences life evaluation. Living in urban areas decreases odds of reporting life as "not poor" by 24.43 percent (β^{p}_{urban} = -0.28 | OR^{p}_{urban} = 0.76) relative to rural areas. Compared to those living in Luzon, the odds to report life as "more than comfortable" are 220.61 percent and 61.49 percent higher for those living in Visayas ($\beta^{spc}_{Visayas}$ = 1.17 | $OR^{spc}_{Visayas}$ = 3.21) and Mindanao ($\beta^{spc}_{Mindanao}$ = 0.48 | $OR^{spc}_{Mindanao}$ = 1.61), respectively.

Satisfaction with community-level public services also contributes to life evaluation. The odds of being "more than comfortable" are 59 percent higher for those who are satisfied with the quality of health services (β^{*}_{health} = 0.46 | OR^{*}_{health} = 1.59) and 115.94 percent higher for those satisfied with educational institutions (β^{spc}_{educ} = 0.77 | OR^{spc}_{educ} = 2.16), compared to those who are dissatisfied.

These results indicate that both objective and perceived factors jointly shape Filipinos' life evaluations. Income and livelihood are the strongest predictors of reporting an "at least comfortable" life, consistent with Easterlin [1974] and Dynan and Ravina [2007], who argue that material resources influence subjective well-being but often through perceptions of adequacy rather than absolute income. Higher income classes, college education, and self-employment all increase the odds of reporting comfort, consistent with Sen's [1987; 1999] and Nussbaum's [1987] emphasis on capability expansion.

Satisfaction with public services and local environments also has substantial influence. Respondents who are satisfied with health and education services or who experience economic stability ("worry-free life") report higher life evaluations, echoing Frey and Stutzer [2002] and Pontarollo et al. [2020] on the role of institutions and community well-being. Interestingly, living outside Luzon and in rural areas is associated with greater perceived comfort, suggesting that regional differences in expectations or social comparison shape well-being—a result consistent with Graham and Pettinato [2002] on relative insecurity in unequal settings.

Overall, the results support international evidence that subjective life evaluation reflects both economic capability and contextual trust in institutions. In the Philippines, the persistence of households reporting that they are "sometimes poor, sometimes comfortable" highlights a pragmatic dimension of well-being grounded in perceived stability and adequacy.

5. Conclusion

The current study used data from a long-term national visioning exercise to examine how Filipinos evaluate their current level of comfort—that is, how they perceive their own living conditions relative to their desired life. Although the survey was not designed specifically to measure subjective well-being, the concept of comfort analyzed here reflects a foundational dimension of well-being: material ease, stability, and adequacy.

The findings show that income, livelihood, and education substantially increase the likelihood of perceiving life as at least comfortable, while satisfaction with community environments and public services also contributes to higher life evaluation. The findings confirm, but also qualify, existing results in the well-being literature. Consistent with Easterlin [1974; 2004] and Dynan and Ravina [2007], income and livelihood remain central determinants of perceived well-being. However, Philippine evidence demonstrates that material resources alone are insufficient to explain how people evaluate their lives. Perceptions of service quality, job security, and economic stability are equally important.

The study contributes to bridging capability-based and subjective well-being approaches. Conceptualizing comfort as self-assessed material sufficiency provides empirical support for Sen's [1987] and Nussbaum's [1987] argument that well-being depends not only on resources but on the capability to convert those resources into a sense of stability and adequacy. Comfort thus represents a tangible component of life evaluation that lies between objective welfare and subjective satisfaction, illustrating how Filipinos reconcile rising incomes with lingering feelings of vulnerability. In this way, the study sheds light on the "well-being paradox" in developing economies, where economic progress coexists with perceived insecurity.

From a policy perspective, improving Filipinos' perceived comfort requires more than income growth. Policies that enhance livelihood stability, expand access to quality education and health services, and strengthen social protection systems can help reduce feelings of vulnerability even among non-poor households. Strengthening local governance and service delivery—especially in rural areas where subjective comfort is higher—may also sustain community trust and satisfaction. These policies align with the AmBisyon vision of a *matatag*, *maginhawa*, *at panatag na buhay*, highlighting that reducing insecurity is as important as raising incomes.

This study acknowledges several limitations. The cross-sectional design limits causal interpretation, and the comfort indicator captures primarily the material dimension of well-being, rather than emotional or eudaimonic aspects. Future research should integrate comfort with broader indicators, such as life satisfaction or affect, to capture the full spectrum of Filipinos' quality of life. Panel or follow-up surveys would help track how comfort perceptions evolve alongside economic and institutional changes. Further extensions could examine the impact of environmental and disaster-related shocks, which are particularly relevant in the Philippines, a country prone to typhoons and natural disasters [Ravago, Roumasset, and Jandoc 2016]. Regularly collecting subjective well-being data would allow policymakers to identify persistent and long-term drivers of Filipinos' life evaluation, enabling more responsive medium- and long-term interventions.

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2025 Nobel Memorial Prize in Economics: Joel Mokyr

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This surveys the main themes found in the work of Joel Mokyr, co-winner[1] of the 2025 Sveriges Riksbank Prize in Economic Science in Memory of Alfred Nobel. A final section reflects on possible lessons for developing countries like the Philippines.

JEL classification: N13, N70, N73, O31, O32, O33
Keywords: technology, science, Schumpeterian growth, propositional and prescriptive knowledge, Industrial Enlightenment, Scientific Revolution, Industrial Revolution

1. Introduction

When the Nobel Committee for the Prize in Economic Science awarded this year's prize to Joel Mokyr, it noted "how fast technology progresses and how it changes the world around us" [Nobel Committee 2025:1]. What probably impressed the committee was the burst of growth in general-purpose technologies[2] in the late 20th and early 21st centuries—among them computers and digitalization, biotechnology, nanotechnology, and of course that new holy grail, artificial general intelligence. It will seem curious at first, therefore, that the person they chose to award is known not for visionary work about the future, nor even about contemporary technological developments but about a period long past, the era during and preceding the Industrial Revolution, from the 1700s to about the 1880s.

2. A typology of growth

It is precisely the *longue durée*, however, that reveals the uniqueness of the current era compared to what preceded it and is also where its roots can be found.

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[1] Half of the prize was awarded to Philippe Aghion and Peter Howitt for their work on Schumpeterian growth models (notably Aghion and Howitt [1992]). See the article by Villanueva [2025] in this issue for a discussion.

[2] Lipsey and Carlaw [2005] defined *general-purpose technologies* (an earlier signification of "GPT") as generic technologies that find widespread use, lead to many applications, and have spillover effects, thereby transforming entire economies and societies. Printing, the factory system, and the steam engine are early examples. Mokyr himself alternatively uses the term "macroinvention."

In his first major work on the topic, *The lever of riches* [1990a], Mokyr traces the series of technological developments that have occurred from ancient times (also see Mokyr [1990b]). His application of a typology of growth[3] based on the nature of technological changes underlying it provides a sharp analytical tool for understanding broad swathes of human history: *Smithian growth* is based on specialization, division of labor, and trade. *Solovian growth* is founded on resource expansion and the accumulation of physical (and human) capital. *Schumpeterian growth*, finally, is based on technological progress proper, which feeds on a constant stream of innovations based on the expansion of useful knowledge.[4]

Mokyr shows how the many high points of growth observed in ancient civilizations were based mainly on Smithian factors. The empires of Rome and China were founded on the productivity of regions specializing in certain crops, minerals, and manufactures. However, in the first place, specialization was possible only because these regions were tied to each other by trade, transport, and common legal institutions that facilitated exchange. The Roman road network with the *Pax Romana* that supported it is a well-known example. Growth episodes founded on Smithian elements, however, ultimately meet their limits in diminishing returns at the extensive margin, the limitations of existing transport technology, the weakening span of control as geographical scope increases and conquered peoples become more heterogenous, and of course inevitable Malthusian factors.

Even Solovian growth, which figured prominently in the late 18th century, is ultimately subject to diminishing returns at the (capital- or land-)intensive margin. Examples are canal- and road-building, land-clearing, and the spread of better agricultural techniques. As Solow's model predicts, however, high saving rates and accumulation of physical capital[5] can deliver only a steady state but not increasing growth of per capita income. In contrast the Schumpeterian growth in the principal capitalist countries from the 1850s onwards was based on a stream of ideas and technological innovations that fed on itself and sustained continuous growth and investment. As Mokyr [2017:4] summarizes in a later work:

> If economic growth before the Industrial Revolution, such as it was, was largely driven by trade, more effective markets, and improved allocations of resources, growth in the modern era has been increasingly driven by the expansion of what was known in the Enlightenment as 'useful knowledge'.

The unique explosion of Schumpeterian growth in Europe from the late 18th century onward, therefore, represents the Great Explicandum for economic

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[3] These distinctions were earlier made by William Parker [1984], but Mokyr systematized and formally applied these terms to the widest swathes of human history.

[4] Elements of these types of growth—Smithian, Solovian, and Schumpeterian—of course always exist simultaneously but the analytical task is determining which kind is characteristic for a certain period.

[5] One might properly include even the accumulation of human capital.

historians, Mokyr included. In particular, the "Great Divergence" (Pomeranz's term), i.e., how and why Europe, beginning with Britain, managed to overtake China—which until as late as 1400 was more technologically advanced—is a question that has preoccupied economists and continues to be debated. Mokyr called China's loss of technological superiority "the greatest enigma in the history of technology" and he constantly returns to the topic in his writing (Mokyr [1990: Ch. 9]; Mokyr [2017: Chs. 16 and 17]). Various alternative explanations have been proposed that point to Europe's advantages over China,[6] notably the former's access to resources through its colonies [Pomeranz 2001], its political and legal institutions [North and Thomas 1975], its peculiar geography and political fragmentation [Jones 1981], and others.

3. Propositional and prescriptive knowledge

While not denying the relevance of these external conditioning factors, Mokyr regards them as neither necessary nor sufficient. He instead focuses his attention on the central variable, which is the internal development of technology itself. In *The gifts of Athena* [2002], Mokyr argues that the rate of technological advancement depends on the scale and intensity of interaction between two parts of useful knowledge, namely knowledge that is prescriptive ("know-how") and that which is propositional ("know-what"). While one might today use the terms "science" and "technology" to distinguish these two, Mokyr in 2002 was careful not to use these terms as if these were two separate spheres. Both types of knowledge may be contained *within* technology itself.[7] Moreover, in history, some propositional knowledge, while predictive and based on observation, might not even strictly be considered "science" but rather embedded causal systems that are mythological or religious.[8]

Mokyr demonstrates that the remarkable interaction and reciprocal reinforcement between prescriptive and propositional knowledge in Europe between 1750 and 1840—the *anni mirabiles*—were decisive in launching the Industrial Revolution proper. This period was distinguished from others by the broad range of major innovations that occurred across a wide range of industries, including power (e.g., Watt's steam engine), metallurgy (e.g., Cort's puddling and

[6] Or, conversely, authors might emphasize China's various liabilities relative to Europe (e.g., its centralized political structures and lack of interstate political competition, the nontechnological bent of its intelligentsia, its labor-abundant endowment that may have discouraged labor-saving innovations, as well as the features of Confucianism that emphasized tradition and stability).

[7] Or, alternatively, known workable techniques, which are observed regularities of nature, may be part of propositional knowledge itself. An example is the well-known ancient fishers' knowledge that herring runs coincide with lunar cycles.

[8] An example is the ancient Egyptian priests' mythological but practically useful explanation of the timing of the annual flood of the Nile as Isis weeping over the death of Osiris. The rising of the star Sirius was astronomically observed as a reliable predictor of the Nile flood. But this single observational regularity needed to be absorbed into a larger causal system, which in this case was mythology or religion, not science.

rolling process), textiles (e.g., the spinning jenny, the cotton gin), and precision machinery (e.g., Maudslay's lathe).

The Industrial Revolution curiously first took hold in Britain, where few of the innovators of the time even had formal training in science or engineering per se [Mokyr 2009:117]. Rather they were mostly practical people—entrepreneurs and craftsmen immersed in the world of work and commerce and able to observe the concrete problems confronting specific industries and self-taught in engineering know-how. What was crucial according to Mokyr, however, was that such men had access to the body of propositional knowledge of their time (*episteme*) as well as a pragmatic mentality to try and apply it. This was exemplified by James Watt (of steam engine fame).

As a maker of mathematical instruments at Glasgow University, Watt was by no means a scientist, yet he was aware of the relevant physical laws scientists worked with (e.g., regulation of vacuums and steam pressure) and the experimental methods they used to achieve and refine their results. He also sought the company and advice of scientists like Joseph Priestley. Hence, even nonspecialists enjoyed low "access costs" to the body of propositional knowledge, which was available through personal contact, general publications, manuals and pamphlets, private correspondence, and exchange through formal and informal social associations—even if not directly through specialized education.

Britain's head start over the rest of Europe at this time lay in the large number and higher literacy of its skilled craftsmen and mechanics in the commercial sector. A less hierarchical and unequal social structure than on the Continent allowed for easier social mixing and intellectual exchange between natural scientists and industrialists.[9] "Above all", Mokyr [2002:65] writes, "Britain was the country in which the gap between those who engaged in propositional knowledge and those who applied it to production may already have been the narrowest by 1700, and it was becoming narrower over the eighteenth century."

After 1860 however—during the Second Industrial Revolution—the interaction and feedback between propositional and prescriptive knowledge would become more intensive, explicit, and directed. In this, Britain would gradually cede leadership to France and Germany, which had after all always been in the forefront of expanding propositional knowledge. Unlike in Britain, formal science and engineering education with an applied bent established itself earlier on the Continent (e.g., the French *ecoles*, the German *Akademien* and later *technische Hochschulen*). Nonetheless these countries were, for various reasons (e.g., wars and the military pre-emption of skills), slower in translating or adopting science in industrial technique. Yet most of the science used by British industrialists in the First Industrial Revolution originated in France and Germany. Papin's early

[9] The Lunar Society of Birmingham, for example, was an intimate dinner club with a wider circle of correspondents whose members included industrialists like Watt, Boulton, and Wedgewood as well as scientists like Priestley, Keir, (Erasmus) Darwin, and Small, among others.

experiments with steam pressure and safety valves were the basis of Newcomen's (and later Watt's) steam engine. Lavoisier's oxygen theory was the foundation for the process for producing soda ash. Harrison's maritime chronometer would have been impossible without the balance spring invented by Huygens.

The more intense mutual feedback between science (for we may now be allowed to call it that) and technology was most vivid in the rapid development of Germany's chemical industries. It was Liebig's foundational work in academic organic chemistry that underpinned the creation of the first artificial dyes (Perkin), an important input for the textile industry. But the latter in turn stimulated the theory of chemical structure (Kekulé). Thus, armed with a modern organic chemistry, German firms like Baden Aniline and Soda Factory (BASF), Bayer, Hoechst, and Agfa, which had originally only produced synthetic dyes,[10] then rapidly became multiproduct giants that moved into the production of other industrial chemicals (e.g., ammonia, nitrates, saltpeter), pharmaceuticals, fertilizers, explosives, and photographic chemicals.

Similar trends, though somewhat slower and subdued, appeared in other countries where firms like *Saint Gobain, Schneider, and Compagnie Générale d'Électricité* (CGE) in France and later General Electric, Dupont, and Standard Oil in the US also systematically deployed science in their operations. This explicit collaboration between science and technology was epitomized by the industrial research laboratory that became a major investment of major corporations. Moreover, techniques already in use (e.g., steam engines and steelmaking) were re-examined, explained *ex post* on more scientific principles, and made more efficient. Even the venture of individual invention passed into the hands of persons with formal engineering backgrounds (e.g., Benz, Daimler, Tesla, Siemens, Steinmetz, and Nobel himself).

From this point on it was clear that self-sustaining Schumpeterian growth was underway. To borrow a metaphor, if technological progress resembled a car rally, prescriptive knowledge remained the driver. However, it now operated under the steady guidance of a navigator—propositional knowledge. Mokyr [2002: Ch. 3] points out how the same mechanism of mutual feedback between propositional and prescriptive knowledge continues to drive industrial innovation and growth to this day. There is little in principle to differentiate between NVIDIA, Samsung, or Huawei today and the giant German chemical companies of the 1850s in terms of how they innovated and put new products on the market.

4. Industrial enlightenment

Explaining the emergence of Schumpeterian growth as the result of the interaction between science and technology, however, merely pushes back the

[10] The origin of such firms in synthetic dyes is still evident in their names, e.g., BASF (Baden Aniline and Soda Factory) or Agfa (Joint-stock Company for Aniline Production).

question of how and why propositional knowledge in Europe became so extensive and available in the first place. Mokyr's [2002, Ch. 2] answer points to two earlier idiosyncratically pan-European phenomena, namely, the Scientific Revolution (16th to 17th century), and a part of the Age of Enlightenment (late 17th to the 18th century) he calls the "Industrial Enlightenment."

The well-known Scientific Revolution was the work of a small transnational intellectual elite, a series of personalities from Galileo to Newton. Mokyr [2017: 180ff] describes how, in the process of competing for patronage and seeking transnational prestige,[11] this group of intellectuals formed a virtual scientific community that was collaborative yet competitive. In the process, they laid the foundations of what came to be accepted as a scientific method (measurement, experiment, and reproducibility), a scientific mentality (the expectation of regularity and order in natural phenomena), and a scientific culture (the idea that science can produce practical results and material benefits) [Mokyr 2002: 36-40]. The work of this tacit "Republic of Letters", culminating in Newton's *Principia*, contributed to the creation of an "open science" (Paul David's term), essentially a public good among its members, that crossed national boundaries. For, notwithstanding national divisions and personal rivalries, intellectuals like Huygens, Boyle, Leibniz, Leuwenhoek, Newton, and others exchanged ideas, critiqued, validated, but more importantly made known their theories and observations through correspondence and publications. "[T]he key to Europe's success was its fortunate condition that combined political fragmentation with cultural unity" [Mokyr 2017:215].

While autonomously expanding the body of science, however, interest in the activities of 16th to 17th century scientists and philosophers was confined mainly to their own circles[12] (e.g., universities, invisible colleges, and academic societies) with little connection to the lives of the rest of the population. It took a second period and a further set of personalities to deliver the results of science to society at large and the productive sector in particular. The Enlightenment (from the early 18th to early 19th centuries) was of course a broad movement encompassing ideas that set out to reform laws, social and civil relations, governance, and science, among others. But Mokyr [2002: Ch. 2] focuses on an aspect that had a direct bearing on production technology, a phenomenon he calls the "Industrial Enlightenment."

As part of their efforts to place society on a rational basis, Enlightenment scientists and philosophers took a more intensive interest in technology and made efforts to lower the cost of accessing the results of formal science. The implicit aim was to put into practice (though belatedly) the Baconian ideal [Mokyr 2017: Ch. 7] that the goal of science is the improvement of the human condition and

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[11] The Frenchman Descartes, for instance, served rulers of Bohemia and Sweden; the Dane Brahe who worked for the Holy Roman Emperor, as did the German Kepler. Huygens, who was Dutch, was employed by France's Louis XIV. Leibniz served various princes alternately in the Holy Roman Empire.

[12] Among other factors, the *lingua franca* of the Scientific Revolution was Latin, which was inaccessible to the broader population.

that it must therefore communicate with the world of industry and commerce. Along these lines, several Enlightenment scientists put their ideas to practical use through useful product- or process-innovations, e.g., Franklin (lightning rod, bifocals), Chaptal (chaptalisation of wine, improved processes of manufacturing industrial chemicals), Berthollet (bleaching and dye-fixing agents), and Lavoisier (production of gunpowder). The greater thrust of the Industrial Enlightenment, however, was to codify and then popularize scientific knowledge through publications, public lectures, academies, salons, and other venues. The epitome of these efforts was Diderot and D'Alembert's massive encyclopedia [1751 to 1772] of "the sciences, arts, and crafts", which aimed explicitly "to change the common way of thinking" and allow people to seek out information for themselves. The encyclopedia was the work of intellectuals and scientists who now focused their rational lens on all aspects of social life, including the world of work and industry.

It was also significant that the Industrial Enlightenment inherited and maintained not only the Scientific Revolution's methods and mindset but also its pan-European, transnational character, so that useful knowledge, helped along by printing technology, flowed even more easily across national borders. Ultimately, this easy access explains why even a relative laggard in organized science like Britain could momentarily seize the lead in the first Industrial Revolution. Mokyr [2002: 76] insists that "[t]he Industrial Revolution followed from the Industrial Enlightenment, which was not a British but a Western phenomenon. The order in which things happened in Europe, the leadership of Britain, and the much-discussed backwardness of France and the Netherlands were second-order phenomena."

5. Culture and institutions

In *Culture of Growth*, his last major work prior to winning the Nobel, Mokyr takes a deeper dive into the ideas that motivated and sustained the Scientific Revolution, which fed the Industrial Enlightenment and in turn led to the Industrial Revolution. Most significant in terms of subsequent economic impact, he finds, was the idea of "progress" itself [Mokyr 2017: Ch. 14]. The idea that progress in science could make a significant contribution to material progress was by no means self-evident to an earlier era. Opposition from those who benefited from or were comfortable with the status quo obviously needed to be overcome (e.g., only recall the inertia and vested interests that sustained Ptolemy's geocentric theory).

What needs explaining, therefore, is how and why the new ideas from the Republic of Letters ultimately prevailed. Mokyr [2017: Ch. 10] has some recourse to enumerating favorable circumstances, among which are the already-mentioned political fragmentation of Europe that promoted competition, the success of voyages of discovery, which exposed Europe to other cultures and technologies, and the fragmentation of the Western Church and its de facto flexibility following the Reformation.[13] These conditions were contingent—which meant the outcome was by no means inevitable—but they created openings for thinkers to espouse novel ideas of intellectual and material progress. Mokyr does not emphasize the role of purely economic factors but concedes that the growing prosperity of merchants and tradespeople created a middle stratum that made for an audience interested in ideas of growing its wealth and its own social mobility. Overall, however, the commercial classes did not seem to play a large role in the Scientific Revolution proper, which remained a pursuit of an intellectual elite.

Mokyr instead cites the importance of "cultural entrepreneurs" [Mokyr 2017: Chs. 7 and 8] notably Bacon and Newton. The former, though not a scientist, was the eloquent harbinger of a pragmatic science—essentially advocating work in Pasteur's Quadrant—that sought fundamental understanding as well as practical application. Newton through his work, on the other hand, demonstrated the power of a scientific approach that integrated mathematical reasoning with data and observation. Bacon's persuasive arguments and Newton's example and credibility were crucial in unifying the opinions of intellectuals who came after. With respect to Newton in particular: "Perhaps the most important contribution Newton's work made to the Industrial Enlightenment was the elegance and completeness with which he explained the regularities that had puzzled people for centuries, which instilled in others confidence about the ability of humans to understand nature" [Mokyr 2017: 113].

Mokyr ultimately comes to grips with another major explanation for European growth—one associated with his friend the late Douglass North—namely, institutions. Secure property rights, reliable contract enforcement, law and order, low rent-seeking, and so on, have been recognized by economists both in theory and through evidence as resulting in positive economic outcomes. Mokyr, however, is unwilling to reduce the explanation of the European Miracle to a question of institutions. While the emergence of positive Northian institutions might promote Smithian growth (resulting, say, in more efficient markets and expanding trade) it does not suffice to explain the rapid development of useful knowledge witnessed in the Scientific and ultimately the Industrial Revolution: "The Industrial Revolution does not seem to have been the response to any institutional innovation" [Mokyr 2017:5-6]. There were moreover any number of societies with fairly sound institutions that did *not* experience a self-sustaining wave of scientific discovery and technological innovation (e.g., the Ottoman Empire, or Ming China). This, for Mokyr, points to the autonomous role of culture, particularly among the elite, in explaining the roots of modern economic growth: "What changed in that age (i.e. 1500-1700) was the culture—the beliefs and attitudes of the educated elite toward useful knowledge, how to acquire it, how to distribute it, and what it could do" [Mokyr 2017:142].

[13] Although, it will be remembered, the Reformation itself was an initially backward-looking movement.

Culture, for Mokyr [2017:8], refers to individually held but socially transmitted "beliefs, values, and preferences that affect behavior." These differ from institutions—whether formal laws or informal norms—which are *external* constraints or incentives society applies to individual behavior, regardless of a person's beliefs and preferences. While culture and institutions may reinforce each other for good or ill, they remain distinct phenomena, with the former given primacy. A culture consistent with good institutions would reinforce the latter. Where the two diverge, however, institutions would probably be weaker or ineffective. While both may mutually affect each other through time, the autonomous existence of culture also means it can change independently and ultimately induce institutional change.

This is precisely what Mokyr contends happened historically: a change in the culture of the intellectual elite—particularly the belief that expanding useful knowledge was key to material progress and welfare—developed gradually, attained social weight and prestige through its achievements, and finally became accepted by rulers and later used by society at large. It was institutions that ultimately followed, often with government encouragement and support, e.g., formal academies and societies, universities with reformed curricula, polytechnics, trade schools, industrial exhibitions, as well as the patent system—and ultimately of course, the industrial research and development (R&D) lab.

The elite origins of the knowledge revolution and Schumpeterian growth make these phenomena even more remarkable, since neither the intellectuals of the Republic of Letters nor the *philosophes* and scientists of the Industrial Enlightenment were power holders. Nor were the industrialists of the Industrial Revolution even a majority of producers in society. Mokyr adopts Hooke's metaphor of a "Cortesian army"[14] that managed to prevail despite its small numbers. The success of those *savants* and *fabricants* rested ultimately on the success of their efforts at demonstrating how the application of useful knowledge could produce wealth and well-being. While ideas and inspiration circulated only among a small number, emulation and competition sufficed to draw in the rest of society.

6. Lessons for developing countries?

There are a number of lessons developing countries can hope to draw from Mokyr's work, notwithstanding that global conditions in the ownership and use of science and technology may have changed since the 19th century.

The key insight clearly remains the need to foster close connections between propositional and prescriptive knowledge if society is to generate a self-sustaining

[14] The metaphor is, of course, unfortunate considering the sordid history of the Spanish conquest of the Americas.

process of innovation. While the contribution of science to commerce and industry is by now universally recognized, making the practical institutional connections between academe and industry remains a challenge in developing countries. The main reason appears structural: most advanced firms in less-developed countries are part of supply-chains of global firms already employing cutting-edge technologies (e.g., chips and semiconductors). This obviates the need for such firms to turn to domestic R&D, whether for product or process innovations.[15] Meanwhile the highest incentives in academe (e.g., in publications and career movements) among many developing countries are often oriented towards contributing to global science, often of a basic nature, a fact exacerbated by the lack of R&D demand from domestic firms to begin with.

Where such circumstances arise, therefore, the mutual feedback between science and technology (i.e., translational research[16]) occurs not in-country but in the developed countries with the most extensive scientific innovation systems. The result is a dis-intermediation of propositional and prescriptive knowledge at the national level. A further complication is that, unlike 19th-century conditions, access costs to advanced technology have become steeper, owing to tighter intellectual property regimes, the inherently tacit nature of actual production practices, and large investments in complementary assets required, which make industrial experiments prohibitive.

Countries that have found a way around these difficulties did so first by doubling down on a policy of openness to the holders of advanced technologies, mainly through the attraction of investments from firms that are global technological leaders. The advantages to such firms in relocating some of their more sophisticated operations has often lain in the presence of a host country's assets that are complementary but cost-advantageous to the firms' operations. These may initially take the form of a skilled labor force, but through time (given the proper policies and incentives), may extend to tapping the country's pool of skilled engineers and technicians, who are then able to access and participate in the more sophisticated technological stages of global value chains. Through various means, ranging from learning-by-doing to sheer imitation and piracy, a country's S&T community may then gradually gain a degree of autonomy, enough to sustain a self-sustaining process of innovation. This certainly explains the start of India's pharmaceuticals, Taiwan's and Korea's chip and electronics industries, and China's modern automotive sector, among others. Albeit in a more roundabout manner, these countries replicated the way Britain's skilled and literate artisans and self-taught engineers accessed the propositional knowledge of their time without themselves being at the forefront of scientific discovery.

[15] For the Philippines, see for example, Mendoza [2024].

[16] As used in medicine, translational research refers to the process using basic research results to produce meaningful applicable results of direct benefit to public health.

The foregoing, however, presupposes the existence of a pool of skilled technicians and engineers that can absorb the latest technology and ultimately acquire agency. Developing countries that have met the most success in this regard appear to have emulated the efforts of France and Germany during the Industrial Revolution to deliberately build up their corps of engineering and technical personnel through trade schools, polytechnics, and technical universities. More recent history has seen similar efforts by developing-country governments to form elite institutes specializing in science and engineering—partially sidestepping the conservatism of their traditional universities. Examples are the Korea Advanced Institute of Science and Technology (1971), the National Taiwan University of Science and Technology (1974), and the Indian Institutes of Technology (from 1951 onwards). Thereafter, of course, even traditional universities fell in line and expanded S&T scholarships and offerings.

But the most basic and daunting question raised by Mokyr's work is whether society possesses (or is ultimately able to develop) a culture that places a premium on the production of useful knowledge (say, as against taking or redistributing wealth). At the aggregate level, progress may of course be measured by R&D spending, or the relative shares of law versus engineering enrollment [Murphy, Shleifer, and Vishny 1991]—at which most developing countries fare poorly. Most researchers attribute these, however, to failures of policy or of institutions. Underlying both, however, Mokyr is unafraid to say, is the *culture* that supports them.

The deeper phenomenon, more subtle and difficult to measure, is how much or how little value a society places on innovation and production. To what activities are social prestige and validation assigned? What are the social rewards to innovation and production versus other activities? And if culture, institutions, and policy all currently conspire to undervalue useful knowledge and its social role, whence will come the cultural entrepreneurs, harbingers of change, enlightened elites—whether from government, industry, or academe—that can shift the equilibrium?

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A stylized version of the Aghion-Howitt growth model

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This short note introduces a compact, self-contained 3 × 3 reduced version of the Aghion-Howitt (AH, Schumpeterian, or creative destruction) model. This stylized reduction aims to capture the three core mechanisms in the AH intuition: (i) innovation (endogenous technological progress), (ii) capital accumulation or production, and (iii) allocation of labor to research & development (R&D) which responds to relative returns. This piece writes the three-equation system, explains every symbol, and outlines the steady-state or balanced-growth conditions as well as the Jacobian for local stability analysis. Developing and emerging economies such as the Philippines, where the R&D sector is actively growing, can benefit from understanding the AH model.

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Keywords: Aghion–Howitt model, endogenous growth, creative destruction, research and development, emerging economies

1. Introduction

After more than three decades, Philippe Aghion and Peter Howitt were awarded the Nobel Prize in Economic Sciences for their model of economic growth through creative destruction. Solow [1956] and Swan [1956] presented the neoclassical growth model with exogenous labor-augmenting technology. Conlisk [1967] modified this model with endogenous technical change, well before Romer [1990], Lucas [1988] and Villanueva [2023; 2021; 2020a; 2020b; 1994; 1971].[1]

This note introduces a compact, self-contained 3 × 3 reduced version of the Aghion-Howitt (AH, Schumpeterian, or creative destruction) model. It is a stylized reduction aimed at capturing the three core mechanisms in the AH intuition: (i) innovation (endogenous technological progress), (ii) capital accumulation or production, and (iii) allocation of labor to research & development (R&D)

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[1] Romer made investments in research and development (R&D) endogenous variables, while Lucas considered investments in education endogenously determined. Villanueva [1971; 2021] incorporated Romer and Lucas in a productivity sector that includes new capital construction and made (i) labor-augmenting technical change endogenous via adopting Arrow's [1962] learning-by-doing [Villanueva 1994; 2020b; and 2023] and (ii) labor participation endogenous via real wage adjustments [Villanueva 2020a].

which responds to relative returns. This short piece writes the three-equation system, explains every symbol, and outlines the steady-state or balanced-growth conditions as well as the Jacobian for local stability analysis. Developing and emerging economies such as the Philippines, where the R&D sector is actively growing, can benefit from understanding the AH model.

2. The model

2.1. State variables

- $A(t)$: aggregate technology or "quality" level (scale variable)
- $k(t)$: capital per worker
- $s(t) \in [0,1]$: share of labor allocated to R&D (innovation intensity)

2.2. Parameters (all positive):

- $\alpha \in (0,1)$: capital share in production
- $\sigma \in (0,1)$: saving rate or the fraction of non-R&D output invested
- $\chi > 0$: productivity of R&D or how effective R&D is in producing technological growth
- $\delta \geq 0$: depreciation of capital
- $n \geq 0$: exogenous population and labor growth or dilution rate
- $\beta > 0$: speed of adjustment of the R&D labor share
- $\kappa > 0$: parameter compressing the production side return to a comparable unit

The functional form for output per worker is:

$$y(t)=A(t)k(t)^{\alpha}.$$

2.3. Dynamics (reduced system)

2.3.1. Technology (innovation)

$$\dot{A}(t) = \chi s(t)A(t) \tag{1}$$

Innovation increases the technology stock proportionally to current technology and the R&D share s. This is the simplest multiplicative specification consistent with endogenous (span-of-control style) growth.

2.3.2. Capital per worker

Assume a fraction $1-s$ of labor produces output and a constant fraction σ of that output is saved (invested). Then investment per worker is $\sigma(1-s)Ak^{\alpha}$. Capital per worker grows net of depreciation and dilution:

$$\dot{k}(t) = \sigma(1 - s(t))A(t)k(t)^{\alpha} - (\delta + n)k(t). \tag{2}$$

2.3.3. R&D labor share (selection/return adjustment)

It is assumed that s responds to the relative expected return to R&D versus production. In reduced form, a logistic or replicator adjustment captures this:

$$\dot{s}(t) = \beta s(t)(1 - s(t))(\chi - \kappa k(t)^{\alpha-1}). \tag{3}$$

2.4. Interpretation

- χ is the marginal return to R&D (per unit of s, expressed in the same units as the production return)
- $\kappa k(t)^{\alpha-1}$) is a reduced-form marginal return to allocating labor to production (marginal product of labor in production scaled into the same units). If χ exceeds that production return, s tends to rise; otherwise, it tends to fall. The logistic pre-factor $s(1 - s)$ pins s to the [0,1] interval and provides diminishing adjustment when s is near 0 or 1. As this is a convenient, standard, and reduced form, one can replace this with any other plausible adjustment rule.

3. Comments on the structure

- Equation 1 is the canonical multiplicative specification of AH style growth: growth in technology is driven by the intensity of R&D and is proportional to the current level.
- Equation 2 is standard capital accumulation with the twist that only the non-R&D fraction produces output.
- Equation 3 encodes profit or return incentives that move labor into or out of R&D. The specific form is a reduced form. A micro foundation would compute expected profits from R&D versus from production and derive a best-response s (or an Euler condition).

4. Balanced growth and steady states

Because A multiplies many terms, the model typically does not have a finite stationary A^* unless $s^* = 0$. Instead, we look for a balanced growth path (BGP) where A and k grow at the same constant rate g and s converges to a constant s^*. From (1):

$$\dot{A}/A = g = \chi s^*. \tag{4}$$

If k grows at the same rate g, then $\dot{k}/k = g$. From (2), dividing by k:

$$g = \sigma(1 - s^*)Ak^{\alpha-1} - (\delta + n).$$

However, on a BGP the level, $Ak^{\alpha-1}$ must be constant. Solve for $k^{\alpha-1}$ using (2), set $\dot{k}/k = g$:

$$g + (\delta + n) = \sigma(1 - s^*)Ak^{\alpha-1} \rightarrow k^{\alpha-1} = \frac{g + (\delta + n)}{\sigma(1 - s^*)A}. \quad (5)$$

From (3), at an interior steady share $s^* \in (0,1)$,

$$0 = \chi - \kappa k^{\alpha-1} \rightarrow k^{\alpha-1} = \chi/\kappa. \quad (6)$$

Combine (5) and (6) to eliminate $k^{\alpha-1}$:

$$\frac{\chi}{\kappa} = \frac{g + (\delta + n)}{\sigma(1 - s^*)A}.$$

Use (4) $g = \chi s^*$ to substitute:

$$\frac{\chi}{\kappa} = \frac{\chi s^* + (\delta + n)}{\sigma(1 - s^*)A}.$$

Solve for the ratio $A(1 - s^*)$ (or for s^* if desired). Rearranging gives one scalar relation between A and s^*; to get numerical s^*, normalise one scale (e.g., set $A = 1$ at one date or solve from microfoundations). The important message: interior s^* exists where marginal returns equalise (Eq. 6), and growth rate is $g = \chi s^*$.

Special corner solutions: $s^* = 0$ gives zero long-run innovation (then A constant) and the model reduces to Solow-style capital dynamics; $s^* = 1$ is extreme full R&D and production collapses. In the AH model, $0 < s^* < 1$.

5. Linearization/Jacobian (for local stability)

Write the vector $X = (A, k, s)$. The Jacobian J evaluated at a generic point A, k, s (compute partial derivatives of RHS of Equations 1 to 3):

$$J = \begin{bmatrix} \chi s & 0 & \chi A \\ \sigma(1 - s)\,\alpha A k^{\alpha-1} & \sigma(1 - s)\,A\alpha k^{\alpha-1} - (\delta + n) & -\sigma A k^{\alpha} \\ 0 & -\beta s(1 - s)\kappa(\alpha - 1)k^{\alpha-2} & \beta(1 - 2s)(\chi - \kappa k^{\alpha-1}) \end{bmatrix}$$

Given reasonable values of the elements of J, all eigenvalues of J have negative real parts so that equilibrium is locally asymptotically stable.

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Book Review

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Collaborative for a Gender-Just Economy

Diane Elson. *The Diane Elson Reader: Gender, Development, and Macroeconomic Policy*. 2025. Newcastle-upon-Tyne: Agenda Publishing.

> What the woman who labors wants is the right to live, not simply exist—the right to life as the rich woman has the right to life, and the sun and music and art. You have nothing that the humblest worker has not a right to have also. The worker must have bread, but she must have roses, too. Help, you women of privilege, give her the ballot to fight with. [Schneiderman 1911][1]

1. Introduction

As the daughter of a trade unionist father and a mother active in local women's organizations, Diane Elson earned a degree from Oxford University at a time when England invested heavily in higher education. Oxford University itself did not grant degrees to women until 1920, less than half a century before Elson received hers in 1968. Schneiderman's eloquent appeal for women to have bread and roses too resonates throughout this book collection of previously published papers by Diane Elson. It not only mirrors her own personal history but also stands witness to a lifetime of damage caused by a retreat of the welfare state while gender injustice persists in the working lives of women around the world.

The Diane Elson Reader covers overlapping themes on gender and the economy, with an emphasis on the challenges of creating an enabling macroeconomic environment for gender-just economic development. Gender equality is treated with much more substance than simply analyzing a social group (i.e., women). Throughout the collection, gender is an institutionalized structure permeating the economy, so much so that its discriminatory and exploitative nature renders entire segments of the economy invisible, thus requiring feminist economists such as Diane Elson to demonstrate the incompleteness of standard economic analysis. The attention given to the macroeconomy—particularly on policies dealing with the policy levers of aggregate demand, which continue to be treated as a highly

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[1] The quote is from a speech by Rose Schneiderman given to middle-class women advocating for the right to vote in 1911 soon after the Triangle Shirtwaist Factory fire in New York City that killed 123 women between the ages of 14 and 23.

specialized field dominated by technocrats who are unlikely to label themselves feminist—is especially noteworthy. Diane Elson has been the leading figure in unpacking the black box of macroeconomics from a feminist perspective.

By showing how an economy is a gendered structure, macroeconomics cannot possibly be gender-neutral, as is often argued, since its nature is embedded within gendered socio-economic structures. Thus, if it is not gender-neutral, then the conceptual frameworks articulated in this book collection help to redefine the economy in ways that better reflect and capture the realities of lives subjected to gendered institutional structures. By extension, in successfully capturing these realities, the possibility and feasibility of designing policies responsive to gender equality is raised. The possibility of having bread and roses too is also strengthened.

2. The chapters

Introductory chapters function as a map guiding readers across the analytical domain of the subject covered. *The Diane Elson Reader* in its introductory chapter covers theories of development, the macroeconomics of development, especially as experienced through structural adjustment programs, the policy reform agenda, financial crises, and the relationship between economic growth and inequality. A chapter is also devoted to gender-responsive budgeting initiatives, which have seen applications in more than 80 countries. The book collection also covers the role of the international financial architecture, often regarded as the purveyors of the macroeconomic policy reform agenda criticized by feminist economists. The introductory chapter's most interesting feature is that it provides context about the period in which one of the chapters was written and then updates the discussion with the progression of the analysis to the present time. In other words, one gets the sense of a history of thought of how Elson's analysis has progressed through the years and its place in the literature, followed by an update of where the analyses stand today.

Chapter 2 operates on the premise that gender relations—the complex socio-economic interactions between and among groups classified by gender identity—have never been integral to the formulation of theories of development. This chapter expounds on this fundamental limitation by examining mainstream development theories, specifically those proposed by Sir Arthur Lewis, Walt Rostow, and Henry Harrod. It also considers counter-proposals from the structuralists, notably Raul Prebisch and Hans Singer. The text further points out that even the Dependency theorists, who were instrumental in highlighting the importance of global politics in shaping development outcomes of poor countries, failed to integrate gender as a meaningful analytical category.

Elson takes the reader through critiques by feminists beginning with Ester Boserup, who argues that women have been excluded in the development processes, to Lourdes Beneria and Gita Sen, who argue that what matters is women's subordination rather than simply exclusion and marginalization. Writing with Ruth Pearson, Elson adds to the analyses a more nuanced understanding of the impact of development processes on women. In analyzing export-oriented industrialization and its tendency to be female-intensive in its labor composition, Elson and Pearson argue that a holistic understanding requires unpacking three tendencies: (a) "a tendency to *intensify* the existing forms of gender subordination", (b) "a tendency to *decompose* existing forms of gender subordination", and (c) "a tendency to *recompose* new forms of gender subordination" [Elson 2025:2]. Feminists did not stop at criticism. Rather, they forged ahead with visions of what alternatives might look like, such as Ingrid Palmer's proposal to redesign policies in ways that reduced gender-based price distortions that effectively lower what she termed as the "reproduction tax" [Elson 2025:33].

Chapter 2 discusses alternatives, recognizing contributions from social movement actors and multilateral agencies in re-envisioning development. It situates development as a process responsive to intersecting asymmetries of power with a particular focus on human development, a recognition that is atypical of works by mainstream economists.

Chapter 3 complements these discussions by examining factors and processes through which women have been excluded, marginalized, and subordinated in the context of development. Elson characterizes the specific nature of gender relations that ensures this consistency of treatment as "male bias in the development process" [Elson 2025:37]. According to Elson, this bias establishes an "ill-founded or unjustified" asymmetry by consistently operating "in favor of men as a gender, and against women as a gender" [Elson 2025:39]. The chapter explains how this bias is experienced individually, operationalized societally, and reinforced by custom and culture. This framework extends to the practice of economics itself, where the implicit assumptions underlying lines of reasoning—particularly gendered division of labor—are often ignored in mainstream analysis.

The structural adjustment programs of the 1980s—a watershed period for development economics and for heavily indebted developing countries—drew substantial criticism from feminists. Chapter 4 highlights Elson's contribution to this theme by focusing specifically on macroeconomics as experienced through adjustment policies, demonstrating how male bias operates under these specific circumstances.

Chapter 5 then discusses the subsequent macroeconomic policy reforms following the period of adjustment, recognizing that the adjustment process involved several phases. These included secondary reforms in trade and sectoral liberalization following the initial stabilization period, which were rationalized as ensuring coherence between meso- and macroeconomics by changing incentive structures to reduce price distortions. However, two critical flaws were identified in this policy framework. Firstly, household and family dynamics at the micro level are assumed to behave as a unit rather than reflecting cooperative conflicts. This premise fails to account for how individual rights (beyond property rights) are changed or inhibited by policy reforms. Secondly, critiques are raised against the explanation of discrimination under new household economics, which misleadingly highlights policy reforms as "advantageous to women by undermining prejudice" [Elson 2025:78]. The justification overlooks the tangible reduction in social rights that commercialization and privatization entail.

Chapter 6 remains focused on macroeconomics and unpacks growth models. This chapter guides analysts on the limits of simple gender disaggregation of the economy or using gendered parameters. While helpful, endogenous growth models that incorporate human capital formation only account for investments in skills acquisition and certification. However, the time and money spent on care work to prepare and support children and adults to enable continuous human capital formation is not included in these models and their measures. In addition, models need also to represent coordination between the spheres of production and social reproduction; simply assuming smooth functioning markets will be inadequate.

Indeed, Chapter 9 engages with debates surrounding economic growth and subsequent inequality. Most discussions on inequality refer to income distribution across a population and not between or among social groups (e.g., gender). Another challenge, brought about by the almost exclusive focus on economic growth, is economic crisis, which Chapter 10 covers. As open economies became more vulnerable to business cycles amid intensifying globalization, Elson highlights how the risks generated by financial sector activities are unevenly distributed across social groups. Similarly, when economies fall into crisis, they increasingly rely on women's work as a social safety net—work that is not inherently funded by the public purse.

Chapter 8 focuses on gender-responsive budgeting initiatives that began in the mid-1990s. Diane Elson was one of three feminist economists that led the theorizing and application of this approach along with Debbie Budlender of South Africa and Rhonda Sharp of Australia. The chapter begins by showing the limitations of fiscal policy under neoliberal models which tend toward austerity and Keynesian approaches that accommodated wider fiscal space but assumed a male breadwinner with dependents. The mid-1990s was a difficult time for feminists to engage with public finance, since there was already a decade of policy reforms that shrank public coffers and publicly-funded institutions. Nevertheless, there was an expansion of gender-responsive budgeting around the world that demonstrated a diversity in approaches. Elson discusses what makes some approaches effective, with institutionalization within the budget cycles being key as well as consistency of public scrutiny, and why many initiatives falter, often due to weaknesses in political structures and challenges of meeting multiple development goals. Perhaps even more challenging, the combination of low fiscal revenues, aid dependence, and the weight of sovereign indebtedness limits the options for budgetary allocations, which have been the key focus of these initiatives. Forward-looking strategies must confront the question of expanding fiscal space and enhancing "fiscal democracy".

Chapter 7 tackles the international financial architecture, referring mostly to the Bretton-Woods institutions and official development agencies that offered aid and concessional financing while also including commercial creditors to sovereign borrowers. Elson emphasizes the expansion of financial markets, their deregulation, and the free flow of capital into and out of economies, speculating over price differentials and investment potential. Multinational banks, investment houses, and credit rating agencies became influential parts of this architecture, having the capacity to determine the fate of entire nations.

As in the discussion in Chapter 10 on financial crises, these activities typically entail risk-taking, and Elson illustrates how the social costs of these risks are borne disproportionately by women, especially those living in developing countries. New international financial architectures intended to promote gender justice must address the three biases found in existing structures, namely (a) the "deflationary bias," (b) "the male breadwinner bias," and (c) the "commodification or privatization bias" [Elson 2025:59]. Responses from multilateral financial institutions have fallen short in their policy advice and response despite these institutions' willingness to expand spending on social welfare and social safety nets, because none of these policies redress these biases.

3. Pathways of inquiry

The Diane Elson Reader coherently ties up the narrative of women's unpaid labor with macroeconomic policies implemented in pursuit of growth within the context of globalization of developing countries. It does so within the same context that these countries attempt to solve poverty and achieve many other development goals. It is best appreciated alongside a companion website that records Elson's other contributions to the field. Among the challenges of engaging in research and teaching in the context of developing countries with underfunded academic institutions is timely access to works of pioneering thinkers. As an open access book, this collection brings Diane Elson's contributions to the field of economics, spanning almost half a century, to the wider audience that it deserves.

The chapters mostly use country case studies from the developing world to illustrate arguments, but some discussions look at European countries going through similar experiences. This breadth of country coverage is valuable so as not to give the impression that the issues discussed are only related to the structure of developing economies. Rather, there is a universality to the refusal to recognize women's unpaid labor in economies, alongside its invisibility in economic theories and resulting policies.

Economists who highly prize theorizing through mathematical modeling and hypotheses testing through econometric analyses may find the book collection disappointing. These individuals are either not the audience for this book, or they have missed the point. Instead, the book challenges these economists to improve upon their theories and analytical methods by reviewing the validity of their assumptions and encouraging them to reconceptualize their models. Indeed, throughout the collection, Elson points to efforts that have pursued and continue to pursue such improvements and reconceptualizations in their mathematical modeling and statistical testing.

The book collection, by showing how Elson's works relate to contributions by other feminist economists, serves as a starting point for developing seminar courses on gender and macroeconomics at the high undergraduate or graduate level. Course development should, however, reflect the challenges of getting gender-aware economics courses approved, given the book's discussion of male bias, as noted in Chapter 3. For additional support in disseminating the contributions of feminist economics, the International Association for Feminist Economics offers resources available on their website and regularly offers a summer school preceding their annual conferences.

Policymakers will also gain much from this book if they are interested in understanding the effectiveness of their work, particularly when recognizing the limits of the growth agenda. This is especially true if there is a desire for a reduction in inequalities not only based on gender but also other forms of injustice. Elson is particularly interested in communicating with policy makers to give them a language that speaks more closely to the realities of their own lives and the lives they witness as they pursue public service, knowing full well that policy debates are unceasing and oftentimes power-laden.

Elson has received recognition for her contributions to the field multiple times, including the Irene Tinker Lecture in 2008, the David Morrison Lecture in International Development in 2009, and the Leontief Prize in 2016. This is testament to her pioneering ideas and her unwavering determination to overcome the challenges of remaining true to her feminist ideals in the economics profession. There has always been a desire for alternatives to the mainstream that are more responsive to inequality and injustice coming from feminists working in government, multilateral institutions, and from social movements. Elson answered the call.

As this book collection demonstrates, the author has opened up pathways of inquiry and proposed conceptual enhancements based on real-world experiences that succeeding generations of economists could propagate until a gender-equal world is normalized.

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Remembering Roberto S. Mariano

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1. Introduction

Dr. Roberto S. Mariano passed away on April 17, 2025, leaving behind a legacy of excellence in academic publications, teaching, mentorship, and institution building.

Dr. Mariano obtained his Bachelor of Arts degree in Mathematics from the Ateneo de Manila University in 1962 and a Master of Science in Statistics from the University of the Philippines in 1963. He pursued his Master of Science in Mathematics at the University of Illinois in 1965. In 1970, he received his PhD in Statistics from Stanford University at the young age of 26.

Dr. Mariano was a distinguished professor at the Department of Economics at the University of Pennsylvania, joining Penn in 1980. In 2002, he moved to Singapore as the Founding Dean of the School of Economics at the Singapore Management University (SMU).

At the time of his passing, he was Professor Emeritus of Economics at both the University of Pennsylvania and the SMU School of Economics. He was also a member of the Board of Directors of the Vatican Financial Supervision and Information Authority, having been appointed by Pope Francis in 2022.

Professor Mariano served on the editorial boards of various academic journals, notably the *Journal of the American Statistical Association*, *International Economic Review*, and *Econometric Theory*. He was also on the editorial advisory boards of the *Philippine Journal of Development* and the *Philippine Review of Economics*.

2. Academic and scholarly contributions

Among his many contributions, Dr. Mariano is best known for having co-developed the eponymous Diebold-Mariano test, a statistical tool designed to compare the predictive accuracy of two different forecasting models. This test has become a standard in the field and remains a valuable tool for researchers.

Beyond his scholarly work, he was deeply committed to nurturing future generations. He mentored many students and researchers in the fields of economics

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and statistics, who have since carved their own niches. They were inspired by his brilliance, humility, integrity, and generosity with his expertise and time.

3. Institution building and policy impact

Dr. Mariano played a pivotal role in advancing the modeling capacity of the institutions he worked with. His work spanned several forecasting and policy simulation models, which enhanced the institutions' ability to provide evidence-based analysis to support policymaking.

Beyond his contributions to academic research, Dr. Mariano consistently applied his expertise to policy-relevant research. He shared his knowledge with many central banks around the world, including the Philippines, to support evidence-based decision-making. He always focused on the broader impact of his work, helping institutions build the necessary capacity to fulfill their mandates. At the Philippine Institute for Development Studies (PIDS), his greatest legacy has been establishing the the groundwork for macroeconometric modelling work, specifically initiating the work on forecasting models, and the training and development of a strong modeling team, which significantly strengthened the institution's policy analysis capabilities.

Dr. Mariano's work was especially crucial during the 1983 Balance of Payments (BOP) crisis in the Philippines, which was triggered by a combination of financial instability, political unrest, and external shocks. The country faced a severe depreciation of the peso, a moratorium on foreign debt repayment, and a deep economic recession. During this period, inflation rates soared, reaching a staggering 46.7 percent in 1984. The highest recorded month-on-month inflation rate was 68 percent in September 1984.

Dr. Mariano spearheaded the establishment of a modelling unit within PIDS. His initial assignment in 1983 was to develop an inflation model capable of forecasting monthly inflation, thereby enabling policymakers to make timely and effective adjustments to mitigate adverse public effects. The model relied on a statistically estimated price equation, which explained the dynamic behavior of monthly Consumer Price Index (CPI) levels based on historical data and factors such as cost-push and demand-pull influences. Despite the challenges posed by rising crude oil prices, currency depreciation, and agricultural shocks, the model's forecasts closely matched actual inflation data, prompting calls from various government agencies and numerous private groups asking for forecasts for the next several months.

Building on the success of the inflation model, PIDS expanded its modeling initiatives to encompass broader macroeconomic issues. Dr. Mariano was instrumental in this effort, having previously collaborated on the development of a macro model with colleagues from the University of the Philippines School of Economics in the 1970s.

The macro model developed under Dr. Mariano's guidance enabled PIDS to generate forecasts and simulate the outcomes of various policy scenarios. This capability proved invaluable to other government agencies, particularly the economic planning agency, NEDA (now DEPDev),[1] regarding the implications of conditionalities attached to International Monetary Fund loans.

Dr. Mariano's expertise and unwavering commitment have greatly enhanced the capacity of PIDS and other institutions, equipping them with the skills needed to fulfill their mandates more effectively and to promote evidence-based policymaking through advanced modeling and analysis. His contributions have laid a strong foundation for future institutional development, fostering innovation in policy-making processes that will continue to influence the field for years to come.

Dr. Mariano will also be remembered as a loving husband to Julie and devoted father to Michael. He was proud of his Filipino heritage and promoted Philippine arts and culture by supporting Filipino artists. He also opened his home to Filipino students studying at Penn.

He, with his wife Julie and son Michael, established a tradition of hosting a dinner at the start of the school year to welcome new Filipino students and provided them with a sense of community.

Dr. Mariano's legacy will continue to inspire all who knew him, shaping the fields of econometric modelling and policymaking for years to come.

[1] NEDA stands for National Economic and Development Authority which was recently renamed Department of Economy, Planning, and Development (DEPDev).

The Philippine Economic Society

Founded 1961

The Philippine Economic Society (PES) was established in August 1962 as a nonstock, nonprofit professional organization of economists.

Over the years, the PES has served as one of the strongest networks of economists in the academe, government, and business sector.

Recognized in the international community of professional economic associations and a founding member of the Federation of ASEAN Economic Associations (FAEA), the PES continuously provides a venue for open and free discussions of a wide range of policy issues through its conference and symposia.

Through its journal, the *Philippine Review of Economics* (PRE), which is jointly published with the UP School of Economics, the Society performs a major role in improving the standard of economic research in the country and in disseminating new research findings.

At present, the Society enjoys the membership of some 500 economists and professionals from the academe, government, and private sector.

- Lifetime Membership – Any regular member who pays the lifetime membership dues shall be granted lifetime membership and shall have the rights, privileges, and responsibilities of a regular member, except for the payment of the annual dues.
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