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# Pigouvian Exploitation, Informality and Economic Growth: Theory and Evidence

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## Abstract

Given perfectly competitive labor markets combined with the profit-maximizing behavior of firms, real wages should equal the marginal product of labor (MPL). However, there is ample evidence that this equality is distorted in various economies in terms of both levels and growth rates. Basing our analysis on a demand-driven distribution and growth model, we investigate the relationship between the wage-productivity gap (also called the Pigouvian exploitation rate in the early literature) and economic growth, and assess how the presence of an informal sector interacts with this relationship. Using annual cross-country unbalanced panel data from 160 countries in a time-series window from 1950 to 2017, we show that informality strongly interacts with this relationship. Specifically, we find that in countries with a larger informal sector (as percentage of GDP), productivity gains are not compensated for by wage increases. Therefore, a larger wage-productivity gap is associated with higher growth rate while the growth regime is more likely to be profit-led.

**Keywords:** *Marginal Product of Labor, Pigouvian Explotation, Wages, Growth, Panel Data, Demand-Driven Growth Models*

**JEL Codes:** *B50, E12, J30, J46, O11.*

# Pigougil Sömürü, Kayıt Dışılık ve Ekonomik Büyüme: Teori ve Gözlem

## Öz

Tam rekabetçi işgücü piyasalarında kâr maksimizasyonu yapan firmaların çalışanlarına verdikleri reel ücretin işgücünün marjinal verimliliğine eşit olması beklenir. Ancak bu eşitliğin birçok ekonomi ve sektörde bozulduğunu gösteren çok sayıda çalışma bulunmaktadır. Bu çalışmada, talep yanlı bir dağılım ve büyüme modeline dayanarak, ekonomik büyüme ve ücret-verimlilik makası (bu makas erken dönem yazında Pigou sömürü oranı olarak da adlandırılmaktadır) arasındaki ilişki incelenmekte ve kayıt dışı ekonominin bu ilişkiyle nasıl bir etkileşim içinde olduğuna bakılmaktadır. Bu doğrultuda, 160 ülkeyi kapsayan ve 1950'den 2017'ye yıl bazlı bir panel veri tabanı kullanılarak kayıt dışı ekonominin bu ilişkiyi anlamlı ölçüde etkilediği ve özellikle de kayıt dışı ekonominin göreceli olarak daha büyük (GSYİH %'si olarak) olduğu ülkelerde verimlilik artışlarının reel ücret artışlarını desteklemediği gösterilmiştir. Bu nedenle ücret-verimlilik makasının yüksekliğinin daha yüksek bir ekonomik büyüme oranı ile beraber hareket ettiği, ancak bu büyümenin kâr çekişli olma olasılığının da daha yüksek olmasına neden olduğu gösterilmektedir.

**Anahtar Kelimeler:** *Emeğin Marjinal Ürünü, Pigougil Sömürü, Ücretler, Büyüme, Panel Veri, Talep Çekişli Büyüme Modelleri*

**JEL Kodları:** *B50, E12, J30, J46, O11.*

## 1. Introduction

The livelihoods of the poor in developing countries often depend critically on economic activity conducted in the informal sector. This sector, sometimes called the shadow, hidden, black, parallel, second or underground economy (or sector) is defined by Hart (2008) as a set of economic activities that takes place outside the framework of bureaucratic public and private sector establishments. Ihrig and Moe (2004) define it as a sector producing legal goods without complying with government regulations, thereby operating without much (if any) government scrutiny. Informal employment accounts for about 50-60 % of employment in a typical emerging market economy while informal output has been estimated at some 35 % of GDP in developing economies, compared with about 15 % in advanced economies.(Elgin and Oztunali, 2012; Elgin et al., 2019) While informality is prevalent worldwide, although mainly in developing economies, the literature is far from reaching a consensus regarding its determinants and effects. One specific reason for this setback is its neglect in the academic literature as it is mainly a problem for developing economies. Nevertheless, in the last two decades, there has been a growing emphasis on issues related to informality, creating a growing literature on its different aspects, such as its relationship and interaction with economic growth.

As is well known, one of the most debated issues in economics concerns the identification of the main determinants or correlates of long-run economic growth. Although our under-standing has improved significantly, various questions remain unanswered. One such issue is the impact of the extent of informality on economic growth. Aiming to fill this gap in the literature, we investigate through the lens of a demand-driven distribution and growth model the relationship between the wage-productivity gap - also called the Pigouvian ex-ploitation rate in the early literature - (see Persky and Tsand, 1974; Flatau, 2001), and economic growth. We aim to understand how the presence of an informal sector interacts with this relationship. Using annual cross-country unbalanced panel data from 160 countries in a time-series window from 1950 to 2017, we show that informality strongly interacts with this relationship. Specifically, we illustrate that in countries with larger informal sectors (as percentage of GDP) productivity gains are not compensated for

by wage increases. There-fore, a larger wage- productivity gap is associated with a higher growth rate and the growth regime is more likely to be profit-led, that is growth is positively (negatively) associated with aggregate profit (wage) share.

Our paper is related to several existing earlier contributions in the literature. Taking into account a wide range of determinants of growth as well as various econometric specifications, Birinci and Elgin (2014) reported an inverted-U relationship between informal sector size and per-capita GDP growth. They show that both small and large informal economies are associated with little growth whereas medium-sized informal economies are associated with higher levels of economic growth. They also observed that the level of GDP per capita significantly interacts with the relationship between informality and growth. Specifically, in high (low) income economies, informal economy size is positively (negatively) correlated with growth. Moreover, when growth is decomposed into three different growth accounts using a simple growth accounting framework - i. e. growth in total factor productivity (TFP), growth in capital-output ratio and growth in labor-, they found that a larger informal economy is associated with lower growth rates of labor and capital-output ratio and higher TFP growth rates. A similar finding was obtained by Elgin and Erturk (2016). However, none of these studies takes into account the presence of the wage-productivity gap between the formal and informal sector, nor do they examine the effects of this gap on growth.

Our study also relate to several empirical and theoretical papers in the demand-driven growth literature, which suggests that the overall impact of changes in wage share (or profit share) on growth determines whether the regime is profit-led or wage-led. Accordingly, because workers tend to have a higher marginal propensity of consumption, a higher wage share can be associated with greater economic growth (e.g., Keynes, 1936; Heintz and Pollin, 2005; Hein and Vogel, 2007; Oyvat, Oztunali, and Elgin 2018). However, rising wages can also crowd out motivation for private investment, thereby reducing the profit share and this relationship. Specifically, we illustrate that in countries with larger informal sectors (as percentage of GDP) productivity gains are not compensated for by wage increases. There-fore, a larger wage- productivity gap is associated with a higher growth rate and the growth regime is more likely to be profit-led, that is growth is positively (negatively) associated with aggregate profit (wage) share.

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The rest of the paper is structured as follows. Section 2 presents a simple theoretical framework that links the presence of informality to the wage-productivity gap and economic growth. Section 3 presents the data and describes the empirical estimation methodology. Section 4 presents and discusses the estimation results. Section 5 concludes.

## 2. Theoretical framework

### 2.1 A simple model

Here we construct and describe a simple demand-led growth model to understand how the presence of informality might interact with the relationship between wages, productivity and growth.

#### 2.1.1 Production

Based on the earlier definition of informality, I will model the informal sector as a highly labor-intensive sector operating on a small scale. Two other characteristics of informality are that it mostly produces final consumption goods and that firms heavily engaged in informal economic activities tend to be smaller. This is also one of the main reasons why self-employment (household producers) was widely used as a proxy for informality in the early literature.

The formal sector output Yf is determined according to the following functional form:

$$Y_f = z_f K_f^{\alpha} N_f^{\beta}$$

Here, $z_f$ denotes the total factor productivity, $K_f$ is the physical capital in the formal sector and $N_f$ is formal labor. Given perfect competition if $\alpha + \beta = 1$, these two parameters can also be interpreted as the capital and labor share of income, respectively. However, we do not impose such a restriction at this point.

The informal sector production function is given by the following expression:

$$Y_i = z_i K_i^{\eta} N_i^{\gamma}$$

Here, informal output $Y_i$ is produced by a production function that uses physical capital $K_i$ and informal labor $N_i$. Again, η and γ can be interpreted as capital and labor shares within informal sector income, respectively, provided they add up to unity. In that case, it is also safe to assume that $\eta < \alpha$ and $\gamma > \beta$, that is the informal sector is more labor intensive than the formal sector.

Finally, the model assumes that the households supplying labor to the labor market are bound by a time constraint; that is, the time devoted to both sectors in the form of the labor supply must add up to a constant given number $T > 0$.

$$N_f + N_i = T$$

### 2.1.2 Demand-Side

For the sake of simplicity, we assume that the model economy is a closed[1] one. The demand side of the economy is modelled by the following equations:

$$C = C_0 + c_{wf} Y_f (1 - \pi_f) + c_{rf} Y_f \pi_f + c_{wi} Y_i (1 - \pi_i) + c_{ri} Y_i \pi_i \quad (1)$$

$$I = \phi_0 Y_f^{\phi_1} \pi_f^{\phi_2} Y_i^{\phi_3} \pi_i^{\phi_4} b^{\phi_5} \quad (2)$$

$$W_f = Y_f (1 - \pi_f) \quad (3)$$

$$W_i = Y_i (1 - \pi_i) \quad (4)$$

$$R_f = Y_f \pi_f \quad (5)$$

$$R_i = Y_i \pi_i \quad (6)$$

Here, equation (1) defines aggregate consumption *C* as a function of different terms. $C_0 \geq 0$ refers to autonomous consumption. $c_{wf}$ and $c_{rf}$ are the marginal propensities to consume by workers and capitalists in the formal sector, whereas $c_{wi}$ and cri are the marginal propensities to consume workers and capitalists in the informal sector. All these propensities are assumed to be non-negative. Following Keynes (1936) and others cited in the introduction, we also assume that $c_{wf} > c_{rf}$ and $c_{wi} > c_{ri}$, that is the marginal propensity to consumer is larger for workers in both sectors.

Next, in equation (2) we define the investment demand function in a similar way to Naastepad (2006) and Oyvat, Oztunali, and Elgin (2018). Here, $\phi_i > 0$ for $i \in \{1, 2, 3, 4, 5\}$ represent the elasticities of investment with respect to formal output, profit share in the

1 Without loss of generality, the model can easily be extended to an open economy model with export and imports. This extended model is available on request from the author.

formal sector, informal output the profit share in the informal sector, and business confidence $b > 0$, respectively.

Finally, the remaining four equations define formal and informal wage payment Wf and $W_i$, and formal and informal profits $R_f$ and $R_i$. Here, $\pi_f$ and $\pi_i$ denote formal and infor-mal profit shares, respectively. Note that the wage-productivity gap in the formal and the informal sectors are implicitly defined by equations 3 and 4. Considering that the marginal products of formal output and informal output are both functions of the total output in these two sectors, it is obvious from these two equations that $\pi_f$ and $\pi_i$ determine the levelof the wage-productivity gap in both sectors.

Next, assuming that total output $Y$ is defined as $Y = Y_f + Y_i = C + I$, we can then find the following analytical expression for the impact of the profit share on the percentage change in formal output below. Notice that we define $\theta$ with respect to the formal measured output only because we argue that the measured output in the data is the formal output. This enables direct comparison against the data.

$$\theta = \frac{\partial Y_f / \partial \pi_f}{Y_f} = (c_{rf} - c_{wf}) + Y_i^{\phi_3} b^{\phi_5} \phi_0 \phi_2 \pi_f^{\phi_2 - 1} \pi_i^{\phi_4} Y_f^{\phi_1 - 1} \tag{7}$$

The first term on the right hand side of equation (7) is negative (due to $c_{wf} > c_{rf}$ ). The equation entails that the economy's growth regime is profit-led if the rising profit share's negative impact through differences in marginal propensities to consume is smaller than than its positive effect through investment. For positive values of $\theta$, the growth regime is profit-led, whereas a negative $\theta$ implies a wage-led growth regime.

Given the physical capital stock of the formal and informal sector (i.e. for a given value of $K_f$ and $K_i$ as well as a fixed value for T , thanks to the time constraint $N_f + N_i = T$,, equation (7) can thus be rearranged as follows:

$$\theta = (c_{rf} - c_{wf}) + b^{\phi_5} \phi_0 \phi_2 \pi_f^{\phi_2 - 1} \pi_i^{\phi_4} f(Y_i) \tag{8}$$

The key dierence between equation (7) and (8) is that the latter includes a function f(.) that denes formal sector output $Y_f$ as a function of the informal sector output $Y_i$, where $f'(Y_i) > 0$. More importantly, it is also clear that the sign of $\theta$ which determines the type of the growth regime signicantly depends on $Y_i$. Taking the formal labor productivity as given (as determined by marginal product of labor dened through the production function), it is obvious from these two equations that when the informal sector size is, say zero, than the rst term ($c_{rf}$- $c_{wf}$); in the right-hand side of the equations dominates the second term and the growth regime is wage-led. However, when the informal sector size increases (absolutely or relative to the formal sector), the second term starts to increase to eventually dominate the first term. Thus, the growth regime less likely to be wage-led or can even become profit-led. The economic mechanism behind this latter effect is that when the informal sector grows,

capital stock and investment decreases because it is less capital intensive than the formal sector. This, however, increases the marginal product of capital, hence investment's positive effect on growth. Undoubtedly, how fast and when this change happens depends on the levels of the various parameters and the coefficients of the model.

## 2.2 Model simulation

To observe the model's behavior under a plausible set of parameters, we provide a simple simulation in this subsection. We need to assign specific values to the various parameters and coefficients.

**Table 1:** Model Parameters

| Parameter | Description | Value | Source |
|---|---|---|---|
| $c_{wf}$ | MPC for formal workers | 0.85 | Estimated |
| $c_{rf}$ | MPC for formal capitalists | 0.65 | Estimated |
| $\phi_1$ | Formal Output Elasticity of Inv. | 1.25 | Estimated |
| $\phi_2$ | Formal Profit Share Elasticity of Inv. | 1.15 | Estimated |
| $\phi_3$ | Informal Output Elasticity of Inv. | 0.45 | Estimated |
| $\phi_4$ | Informal Profit Share Elasticity of Inv. | 0.05 | Estimated |
| $\phi_5$ | Business Confidence Elasticity of Inv. | 0.11 | Estimated |
| $\pi_f$ | Formal Profit Share | 0.47 | Penn World Tables 9.1 |
| $\pi_i$ | Informal Profit Share | 0.25 | Cantekin and Elgin (2017) |

Unfortunately, there are no directly available values for all the parameters of the model that are valid for all countries. Further complicating the issue, there are several measurement issues for informality while firm and household-level micro data are needed to assign specific values to these parameters. This makes it very difficult to find values that are consistent and robust across different economies. To overcome this issue, we rely on several variables reported in Penn World Tables 9.1 (PWT) as well as some cross-country panel regressions.

First, we calculate the formal profit share πf from PWT by subtracting the labor share of income from unity. 0.46 is the average formal profit share of all the economies for which labor share data is available in PWT. For the informal profit share πi, we rely on Cantekin and Elgin (2017), who calculated these values from a firm-level survey of 1,000 representative firms in Turkey[2] The marginal propensities are calculated from these two values using a simple panel data estimation of equation (1) while investment elasticities are calculated from equation (2). In the estimations of these two equations, Yi values were obtained from Elgin et al. (2019) while we used the Investment Profile Index of the International County Risk Guide as reported by the PRS Group to calculate b. All parameter values are reported in Table 1.

2 As informal profit share data is available only from the Turkish economy, we have chosen to proceed with values from Turkey. At about 28 %, Turkey, along with Mexico, has the largest informal sector as a percentage of GDP among OECD economies, which is approximately equal to the world (unweighted) average (Elgin et al., 2019).

**Figure 1:** Effect of the Profit Share on Formal Output for Different Levels of Informality

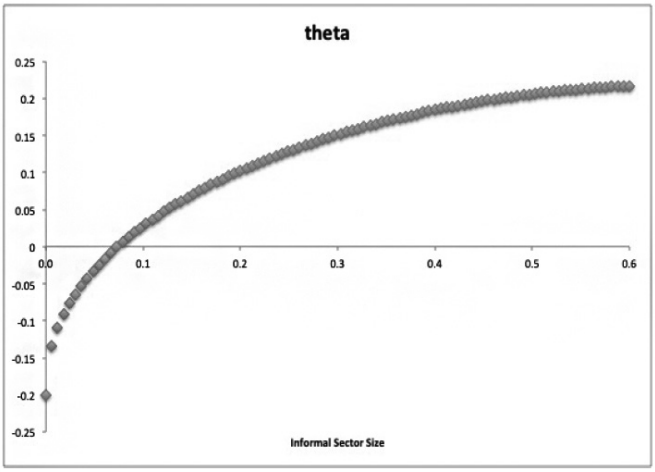



Figure 1 illustrates the behavior of $\theta$, as defined by equation (7) or (8) for different informal sector sizes. As we can see from this figure, increasing informal sector size (as a fraction of formal output) from 0 to 1, increases the value of $\theta$ from negative (wage-led growth) to positive values (profit-led growth). The reason behind this behavior is that initially when relative informal sector size is zero, $\theta_i$ is negative, due to the fact that $c_{rf}$ is less than $c_{wf}$. However, when informal sector size increases, the second term on the right hand side of the equation 7 or 8 starts to increase and therefore $\theta_i$ increases and even becomes positive. Although a negative initial value for $\theta$, i.e wage-led growth, is guaranteed as long as $c_{rf} < c_{wf}$, for a different set of parameters other than the ones we used in our simulation, $\theta$ can stay negative even if informal sector size increases. Moreover, we should also notice that the range in which $\theta$ varies, from -0.20 to about +0.20, is not extremely large. However, this range very much depends on the set of parameters used in the simulation. This range varies between countries because of different country-specific parameter values.

## 3. Empirical Analysis

In this section, we present the results of an econometric analysis based on annual cross-country panel data and test two hypotheses based on the results from the model constructed in the previous section:

**Hypothesis 1** Ceteris paribus, a larger wage-productivity gap is associated with slower growth.

**Hypothesis 2** Informal sector size significantly interacts with the relationship between the wage-productivity gap and growth. Specifically, as informal sector size increases, the corre-lation between the wage-productivity gap and the growth rate also increases.

### 3.1 Data

We use annual cross-country (highly balanced) panel data covering 127 economies from 1950 to 2016. Informal sector size as a percentage of GDP was obtained from Elgin et al. (2019).

Wage (or labor) share of income, government spending (% GDP), real GDP per-capita, trade openness (defined as the ratio of the sum of exports and imports to GDP) and the dependent variable, GDP growth rate, were all acquired from PWT 9.1. Finally, the institutional quality index was constructed from the PS Group's International Country Risk Guide as the sum of three sub-indices, namely corruption control, bureaucratic quality and investment profile. Finally, we calculated the wage productivity gap following Persky and Tsang (1974), using the ratio of MPL to real wages. MPL in the formal sector was calculated using the production function defined in the previous section along with the PWT data. Wage series were obtained by constructing the most comprehensive data series yet, using several different sources including the UNIDO, AMECO and ILO databases.

### 3.2 Methodology

For the benchmark regression equation we use the fixed-effects estimator with country and year fixed-effects. In this case the regression equation is as follows:

$$Growth_{i,t} = \alpha_0 + \alpha_1 Gap_{i,t} + \alpha_2 Gap_{i,t} \cdot IS_{i,t} + \sum_{k=3}^{n} \alpha_k X_{k_{i,t}} + \mu_i + \gamma_t + \epsilon_{i,t}$$

Moreover, to check the robustness of our benchmark results and especially to address the potential existence of endogeneity, mean reversion dynamics and two-way causality, we also run an instrumental variable regression by using lagged independent variables as instruments for the levels of the regressors. Finally, to capture persistence and to address possible existence of mean-reverting dynamics we also run a dynamic panel data regression using the Generalized Method of Moments (GMM) estimator[3] a la^ Arellano and Bond (1991).

In both the IV and dynamic panel data estimations, p-values corresponding to two tests are also provided for all tables. One of these tests is the Hansen J-test for over-identifying restrictions while the other is the AR (2) test for autocorrelation. These tests support the exogeneity of the instruments and the absence of autocorrelation in the specified order, respectively.

3 We conducted further estimations to address possible two-directional causality. We also ran regressions using the IV estimator of Anderson and Hsiao (1982). These are available on request from the corresponding author.

## 4. Estimation results and discussion

**Table 2:** Panel Regressions:

| Dep. Var.: Growth | | | | | | |
|---|---|---|---|---|---|---|
| | FE | FE | FE | FE | IV | GMM |
| Gap | -0.51*** | -0.53*** | -0.52*** | -0.54*** | -0.28** | -0.99*** |
| | (0.19) | (0.20) | (0.20) | (0.20) | (0.22) | (0.24) |
| IS | -0.34* | -0.33* | -0.27 | -0.25 | 0.07 | -0.04 |
| | (0.19) | (0.18) | (0.19) | (0.15) | (0.16) | (0.17) |
| IS· Gap | 1.45** | 1.42** | 1.43** | 1.49*** | 0.99*** | 2.16** |
| | (0.44) | (0.45) | (0.47) | (0.39) | (0.20) | (0.32) |
| Gov. Exp. | | 0.37* | 0.36* | 0.34 | 0.20 | 0.17* |
| | | (0.20) | (0.19) | (0.20) | (0.18) | (0.10) |
| GDP-cap. | | | -0.05* | -0.05* | -0.02** | -0.01 |
| | | | (0.03) | (0.03) | (0.01) | (0.01) |
| Inst. Qual. | | | | 0.07** | 0.11** | 0.17** |
| | | | | (0.03) | (0.05) | (0.08) |
| Openness | | | | 0.08 | -0.04* | -0.11 |
| | | | | (0.07) | (0.02) | (0.07) |
| Growth(-1) | | | | | | 0.88* |
| | | | | | | (0.17) |
| R-Squared | 0.30 | 0.39 | 0.45 | 0.46 | | |
| Observations | 7111 | 7111 | 7111 | 3220 | 3070 | 2918 |
| J-test | | | | | 0.00 | 0.00 |
| F-stat (p-value) | 0.00 | 0.00 | 0.00 | 0.00 | | |

*All regressions include a constant as well as country and year dummies. Robust standard errors are reported in parentheses. *, **, *** denote 10, 5 and 1% confidence levels, respectively.*

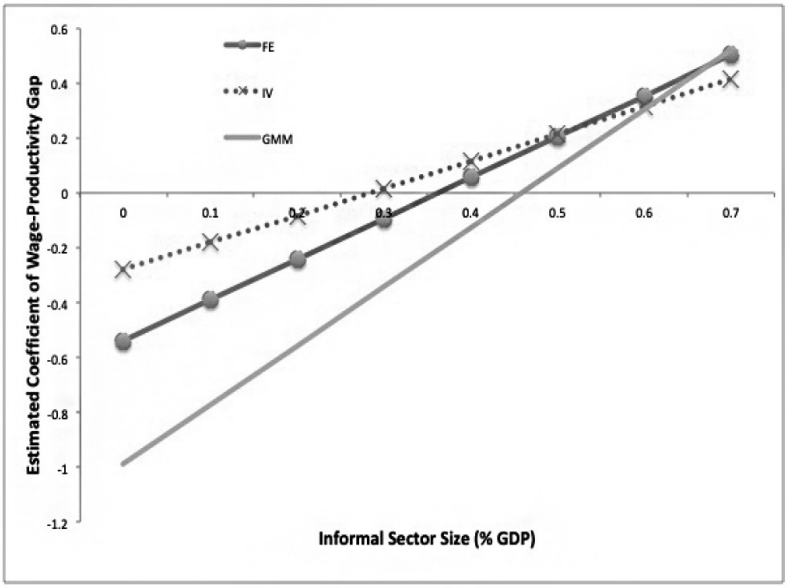
The six regression estimation results are reported in Table 2. The first four columns present the results of the fixed-effects estimations, the fifth column presents the IV estimation while the last column presents the GMM estimation. Overall, all the estimation results are in line with the model simulation. Specifically, even though the level of the coefficient changes significantly, especially in the last two regressions, the estimated coefficient of the wage-productivity gap (denoted by Gap in the first row of the table) is significantly negative in all regressions. The estimated coefficient of the informal sector size is significantly negative in only the first regression. However, the coefficient of the interaction term between informal sector size and wage productivity gap (denoted by IS · Gap in the table) is significantly positive in all regressions. This suggests that the size of the informal sector significantly affects the relationship between the wage-productivity gap and growth. That is, as the informal sector expands, the negative correlation between the gap and growth increases so that it can eventually even become positive.

Figure 2 plots the estimated coefficient of the wage-productivity gap including the in-teraction term against informal sector size for the last three regressions. In the plot, FE de-

notes the last fixed effects regression, IV denotes the instrumental variable regression and GMM is the last regression from Table 2. Although the point where the sign of the correla-tion between the wage-productivity gap and growth becomes positive as the informal sector grows varies across the regressions, the results are qualitatively highly similar.

Turning to the other variables, institutional quality is significantly positive in all regres-sions; i.e. better institutions are associated with higher GDP growth rates. The lagged dependent variable in the final dynamic panel data GMM regression also has a highly sig-nificant positive coefficient. GDP per-capita is significantly negative except for the last GMM regression, offering some weak evidence in favor of convergence. Similarly, govern-ment spending (as a percentage of GDP) is significantly positive in the two fixed-effects regressions and the GMM regression. Finally, trade openness is only significant in the IV regression. These non-robust significances are generally consistent with the empirical growth literature. However, the main message arising from Table 2 is that the empirical analysis is largely consistent with the model presented in the previous section.

**Figure 2:** Estimated Effect of the Wage-Productivity Gap on Growth (inclusive of informal sector size)




## 5. Conclusion

In this paper we examined the relationship between the wage-productivity gap through the lens of a demand-led distribution and growth model to provide empirical support for our theory and mechanism. We showed that a larger wage-productivity gap is associated with a higher growth and the growth regime is more likely to be profit-led; that is, growth is positively (negatively) associated with the aggregate profit (wage) share. Nevertheless, this

issue deserves further attention by economists. First, the theoretical model we presented can be extended by endogenizing labor productivity. In the current paper, labor productivity did not play an active role and was assumed to be exogeneous. That is, the only driving force for the wage-productivity gap in the model is wages. Although endogenizing productivity will not change the basic message of our model, it would suggest different possible mechanisms. Second, the closed economy model could be opened to international trade to determine if interesting dynamics can arise from this. Finally, while we provided some explanation on how and why informal sector size affects this relationship, we did not test this mechanism empirically. We leave these extensions for future research.

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