Does One Law Fit All? Cross-Country Evidence on Okun's Law

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September 2016
Preliminary draft

Abstract

This paper compares the performance of Okun's Law in advanced and developing economies. On average, the Okun coefficient—which measures the short-run responsiveness of labor markets to output fluctuations—is about half as large in developing as in advanced countries. However, there is considerably heterogeneity across countries, with Okun's Law fitting quite well some for a number of developing countries. We have limited success in explaining the reasons for this heterogeneity. The mean unemployment rate and the share of services in GDP are associated with the Okun coefficient, whereas other factors such as indices of overall labor and product market flexibility do not appear to play a role.

1. Introduction

The short-run relationship between output and labor market outcomes, documented by Okun (1962) for the United States, has since become famous as "Okun's Law". Ball, Leigh and Loungani, henceforth referred to as BLL (2016), show that Okun's Law has held up well for a set of 20 advanced economies. The responsiveness of unemployment or employment to output— the so-called Okun coefficient—does vary across countries, however, and for reasons that are not easy to explain.

This paper extends that work to a larger group of countries that includes several developing economies. The motivation is two-fold. First, these countries account for a large, and growing, share of the global labor force. Hence, understanding the determinants of labor market outcomes in these countries is important. There is ample evidence that job creation contributes to individual and social welfare, whereas unemployment and job loss are associated with persistent loss of income, health problems, and breakdown of family and social cohesion (see the World Bank's *World Development Report* on "Jobs" (2013) and Dao and Loungani (2012)).

A second motivation is to probe the common perception that labor market outcomes in developing countries reflect mostly structural factors rather than short-run cyclical fluctuations. Whether this perception is correct has important policy implications. If cyclical fluctuations account for a substantial part of labor market developments, macroeconomic stabilization policies—such as central bank actions, countercyclical fiscal policies and prudential policies to mitigate financial crises—gain in importance relative to structural policies (e.g. improving education and skills of the labor force).

The bulk of the literature on Okun's Law has been for advanced economies; the studies for developing economies have been for particular countries or sometimes for regions. To our

knowledge, this paper provides the first comprehensive look at Okun's Law for a large set of countries over a fairly long period of time. We use 71 countries in our analysis, classified into 29 advanced and 42 developing countries. We use the IMF's *World Economic Outlook* classification to decide which countries are considered 'advanced'; the others are labeled developing. We restrict our sample to countries with at least 20 years of annual data and with a population exceeding 3 million. The time period is 1980 to 2015 but data for many developing countries starts later, as indicated in Table A1 in the Appendix.

Our three principal conclusions—based on estimating the short-run (annual) relationship between unemployment (or employment) and output—are as follows:

1) On average, labor markets are less responsive to output fluctuations in developing countries than in advanced. For instance, the responsiveness of unemployment to output is -0.2 in developing countries compared with -0.4 for advanced economies. The fit of Okun's Law is also poorer in developing countries than in advanced: the average R-square value is in the 0.2-0.3 range, again about half that in advanced countries.

2) However, as found by BLL (2016) for advanced economies, there is considerable heterogeneity across developing countries in the Okun coefficient and the fit of Okun's Law for developing countries. Hence there are a number of developing countries where short-run cyclical fluctuations appear to play an important role in labor market developments.

3) We have limited success in explaining the heterogeneity in Okun coefficients. As in BLL (2016), we find an association between the Okun coefficient and the mean unemployment rate. The other variable that plays a role is the share of services in GDP, consistent with suggestions from the literature, e.g. Kapsos (2005).

The rest of the paper is organized as follows. Section 2 reviews Okun's Law, Section 3 presents the main results and Section 4 delves into the determinants of cross-country differences in Okun coefficients. Section 5 provides our tentative conclusions.

2. Okun's Law

Okun's Law is an inverse relationship between cyclical fluctuations in output and the unemployment rate. Shocks to the economy cause output to fluctuate around potential and lead firms to hire and fire workers, changing the unemployment rate in the opposite direction. This relation can be expressed as:

$$u_t - u_t^* = \beta(y_t - y_t^*) + \varepsilon_t \tag{1}$$

where u_t^* and y_t^* are the trend components of the unemployment rate and log output, respectively. The error term of equation (1) captures factors that shift the cyclical unemployment-output relationship, such as unusual changes in productivity or in labor force participation.

The coefficient β in equation (1) in turn depends on how much firms adjust employment when output changes and on the cyclical response of the labor force:

$$e_t - e_t^* = \beta^e(y_t - y_t^*) + \varepsilon_{et} \tag{2}$$

$$l_t - l_t^* = \beta^l(y_t - y_t^*) + \varepsilon_{lt} \tag{3}$$

where l_t^* and e_t^* are the trend values of the log of labor force and employment, respectively. The smaller is the cyclical response of the labor force, the stronger is the inverse correlation between β and β^e.

The data on the unemployment rate, employment, labor force and real GDP come from the IMF's *World Economic Outlook* database and are described in the Appendix. To measure the trend values of the unemployment rate, output, employment and the labor force, we use the Hodrick-Prescott (HP) filter. The smoothness parameter (λ) in the HP filter is set equal to 100 in our baseline results, but we check for sensitivity to an alternate value of $\lambda=12$.[1]

Another version of Okun's Law posits a relationship between the changes in the unemployment rate and the growth rate of output:

$$\Delta u_t = \alpha + \gamma \Delta y_t + \omega_t \tag{4}$$

The corresponding equations for employment growth and labor force growth are given as:

$$\Delta e_t = \alpha^e + \gamma^e \Delta y_t + \omega_{et} \tag{5}$$

$$\Delta l_t = \alpha^l + \gamma^l \Delta y_t + \omega_{lt} \tag{6}$$

In this paper we do not tackle the issue of whether the gap version or the changes version should be the preferred specification of Okun's Law. Often the changes version is used by authors because it does not require an explicit measurement of the trend components. But this is not a real solution because implicit assumptions about the trend components end up being subsumed in the constant term of equation (4) and in the error terms. We present evidence on both versions of Okun's Law and leave resolution of which one is more appropriate to future research.

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[1] To address the well-known end-point problem with the HP filter we extend all series to 2021 using the IMF's World Economic Outlook projections and then run the HP filter on the extended series to derive the trend estimate for 2015.

3. Main Results

A. Summary statistics

The top panel of Figure 1 shows the histogram for the estimated β coefficients for the two groups. The average value of the coefficient is -0.4 for advanced countries and -0.2 for developing countries. For both groups there is considerable heterogeneity; the standard deviation is 0.18 and 0.14 for advanced and developing countries, respectively. The bottom panel provides evidence on the fit of Okun's Law as measured by the R-square statistic of the unemployment gap regressions. The average value in advanced countries is twice that in developing (0.6 compared with 0.3), but again with a lot of heterogeneity within each group.

This pattern of results broadly continues in Figure 2, which shows the histograms of the β^e estimates and the R-square values of the employment gap regressions. The mean value in advanced countries is a bit more than twice that in developing (0.6 vs. 0.25); the mean R-square value is also more than twice the value (0.5 vs. 0.2); and there is substantial variation within each country group as shown in the histograms and the reported standard deviations.

The distribution of β^l estimates is different in the two groups, as shown in the top panel of Figure 3. In advanced countries, the coefficient is positive in all but two cases; in contrast, in developing countries, the distribution is centered on zero, with nearly as many positive β^l estimates as negative ones. The fit of these equations is quite low for both groups, as shown in the bottom panel of Figure 3: the average R-square values are about 0.2 and 0.1 for advanced and developing countries, respectively.

To summarize, as a broad characterization, Okun's Law holds about half as well in developing countries as in advanced: the average β coefficient and average R-square value are both about half that in advanced countries. The weaker unemployment response to cyclical

fluctuations in developing countries is partly because of a smaller employment response (β^e is smaller on average); in some cases the countercyclical response of the labor force (negative value of β^l) adds to the weaker unemployment response.

Using the changes version of Okun's Law does not lead to a major change in this assessment. The histograms of the estimates of γ, γ^e and γ^l are shown in Figures 4, 5 and 6, respectively. The mean values of the γ and γ^e coefficients are again much higher for advanced than for developing countries, though not quite twice as high as was the case with the gap version (see Figures 4 and 5, top panels). The fit of the employment equation is not as good in the changes version as in the gap version (Figures 5, bottom panel). The distribution of γ^l and the fit of the labor force equation is quite similar in the changes and gap versions (Figure 6).

While useful, a focus only on the averages misses the substantial heterogeneity illustrated in the histograms. Understanding some of the sources of this heterogeneity requires a closer look at the country-by-country estimates. We turn to this in the next sub-section and in Section 4.

B. Estimates by country

The country estimates that underlie Figures 1-6 are given in Tables 1-6. The main points from these tables are the following:

- For advanced economies, with only one exception (Singapore), the estimates of β are all negative and significantly different from zero; for developing economies, the Okun coefficient is negative and significant in 36 out of 42 cases (Table 1). Okun's Law appears to hold well in Poland and Colombia, with Okun coefficients of about -0.7 and -0.4, respectively, and R-square values that exceed 0.4. For South Africa, the coefficient is

-0.33, but the R-square value is low (0.16). For Russia, Okun's law fits well but with a small coefficient, about -0.15.

- For advanced economies, the coefficient estimate of β^e is positive and significant in all cases; for developing economies, the coefficient is positive in 30 out of 38 cases and significant in 23 of them (Table 2). The largest coefficients are for South Africa and Egypt (both exceeding 0.8), though the R-square is low in the former case and high in the latter. Poland, Hungary and Chile are other countries with high coefficients and reasonably good fit.

- Table 3 presents estimates of the cyclical response of the labor force. In advanced countries, the coefficient estimates are positive in all but two cases, and significantly so in 20 cases. For developing countries, the coefficients are positive in about half the cases, though often not significant. For both groups the R-square coefficients are fairly low.

- Tables 4, 5 and 6 provide the estimates of γ, γ^e and γ^l. These do not substantively alter the main points given above. One difference, as already noted, is that the changes version of the employment equation does not fare as well as the gap version: fewer estimates of γ^e are significant and the fit of the equation is worse.

Table 7 classifies countries into a 3x3 matrix based on the absolute values of β and the R-square statistic. In 18 countries, Okun's Law does poorly on both dimensions. In the other cells, the performance improves along at least of the dimensions. Figure 7 illustrates four cases—Colombia, Egypt, Poland and Russia—where Okun's Law appears to hold well.

4. Determinants of Okun coefficients

In this section we look into some of the factors that are associated with the cross-country variation in β and β^e. The seven factors we consider are those suggested by previous studies. We first present a set of scatter plots to show the bivariate relationship between β and each of the seven factors (Figures 8-14). In each figure, we show the slope of the estimated relationship for the full sample as well as separately for the advanced and developing country groups.

Mean unemployment rate: BLL (2016) document a positive relationship for advanced countries between the estimated Okun's coefficient and the average level of unemployment: in countries where unemployment is higher on average, it also fluctuates more in response to output movements. While the reason for this association is not apparent, we find that a similar correlation holds for developing economies as well (Figure 8).

Per capita GDP: The histograms showed a difference between the average values of the Okun coefficients between advanced and developing countries. Since the segmentation of the countries in the two groups was based on income, per capita GDP is an obvious candidate to explain some of the cross-country heterogeneity. As shown in Figure 9, for both the overall sample and for the developing countries group, there is a negative relationship between per capita GDP and the Okun coefficient: in countries with higher per capita GDP, unemployment is more responsive to output fluctuations. However, the relationship does not hold for countries within the advanced country group.

Size of the shadow or informal sector: Agénor and Montiel (2008) and Singh, Jain-Chandra, and Mohommad (2012) discuss the importance of the shadow or informal economy in developing economies; the existence of this sector can obscure relationships between the formal labor market and measured output, thus lowering the measured Okun coefficient. This view finds some confirmation in the data: Figure 10 shows that for the full sample of countries, labor market and output fluctuations are less correlated in countries with larger shadow economies.

Share of services in GDP: Kapsos (2005) and Crivelli, Furceri, and Toujas-Bernaté, (2012) document that in countries where the service share is higher, employment tends to be more responsive in changes in output. We find a similar association for the full sample and for developing countries (Figure 11).

Skill mismatch: Estevao and Tsounta (2011) suggest that skill mismatches can play a role in influencing how unemployment responds to shocks and present evidence supporting this from U.S. states. They measure skill mismatch as the difference between the skills embodied in the employment structure of a state ("demand") and the skills reflected in the educational attainment of the state's labor force ("supply"). Melina (2016) has constructed similar measures of skill mismatch for many of the countries in our sample. We find that, for developing countries in particular, higher levels of skill mismatch are associated with a weaker response of unemployment to output (Figure 12).

Labor market and business regulations: Many observers suggest that the responsiveness of labor markets could depend on regulations governing labor and product markets. For instance, in

discussing hiring and firing regulations in Middle Eastern and North African countries, Ahmed, Guillaume, and Furceri (2012) argue that such regulations can discourage "firms from expanding employment in response to favorable changes in the economic climate." That is, greater employment protection can dampen hiring and firing as output fluctuates, reducing the employment responsiveness. We find little association between the Okun coefficient and aggregate measures of either labor market flexibility (Figure 13) or product market flexibility (Figure 14). Looking at individual components of these aggregate measures could yield stronger results; we plan to investigate this in future work.

Table 8 reports regression results. When all variables are entered in the regression together, only the effects of average unemployment and the share of services are statistically significant, as shown in the first column of the regression. Dropping the mean unemployment rate—on the grounds that it is not truly a causal factor—does not change things much (second column). The third includes only the average unemployment and the share of services; this regression has an adjusted R-square of 0.5, not much lower than the one in the first column. The three other column of the Table repeat the exercise for β^e, reaching broadly similar results, though in this case the difference in R-square values between the regression with all variables and the one with only two variables is more pronounced (0.48 vs. 0.33).

5. Conclusions

The structural challenges facing labor markets in developing economies deservedly get a lot of attention. In many of these economies, unemployment rates, and particularly youth unemployment rates, are alarmingly high. Others face the challenge of raising labor force participation, particularly among women. The results of this paper lend support to a focus on policies to address these structural challenges relative to the cyclical considerations that are more dominant in advanced economies. We find that the cyclical relationship between jobs and growth is considerably weaker, on average, in developing than in advanced economies. At the same time, the finding of a significant Okun's Law relationship in many developing countries suggests that cyclical considerations should not be ignored. Aggregate demand policies that support output growth in the short term are also needed to keep many of these economies operating closer to full employment.

Figure 1: Unemployment gap equations: Histograms of β estimates and $Adj\ R^2$

Gaps Specification

Advanced: Mean = -.39, Sd = .18, N = 29
Developing: Mean = -.2, Sd=.14, N=42

Gaps Specification

Advanced: Mean = .59, Sd = .2
Developing: Mean = .29, Sd=.24
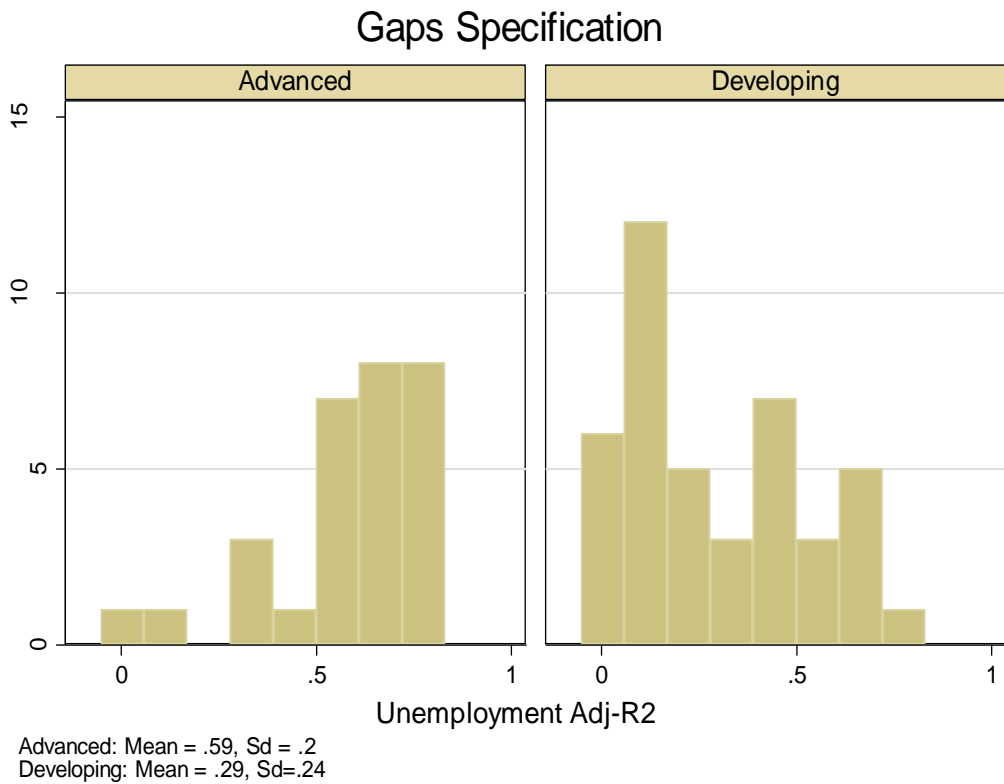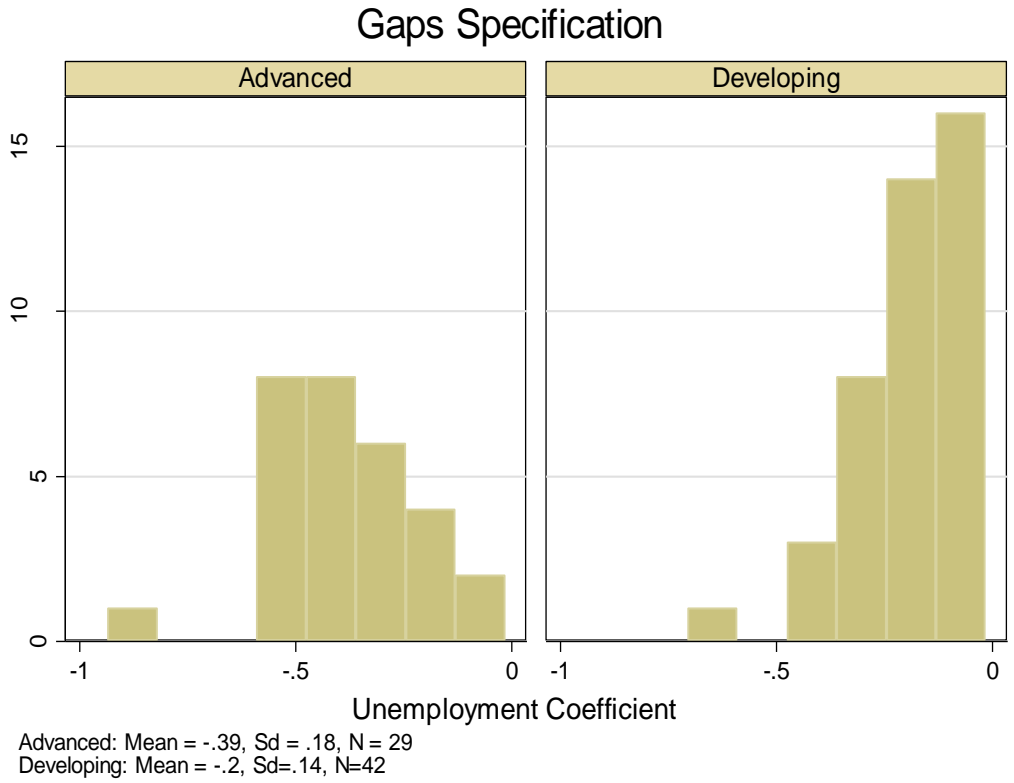
Figure 2: Employment gap equations: Histograms of β^e estimates and $Adj\ R^2$

Gaps Specification

Advanced: Mean = .62, Sd = .25, N = 29
Developing: Mean = .26, Sd=.26, N=38

Gaps Specification

Advanced: Mean = .53, Sd = .2
Developing: Mean = .2, Sd=.23
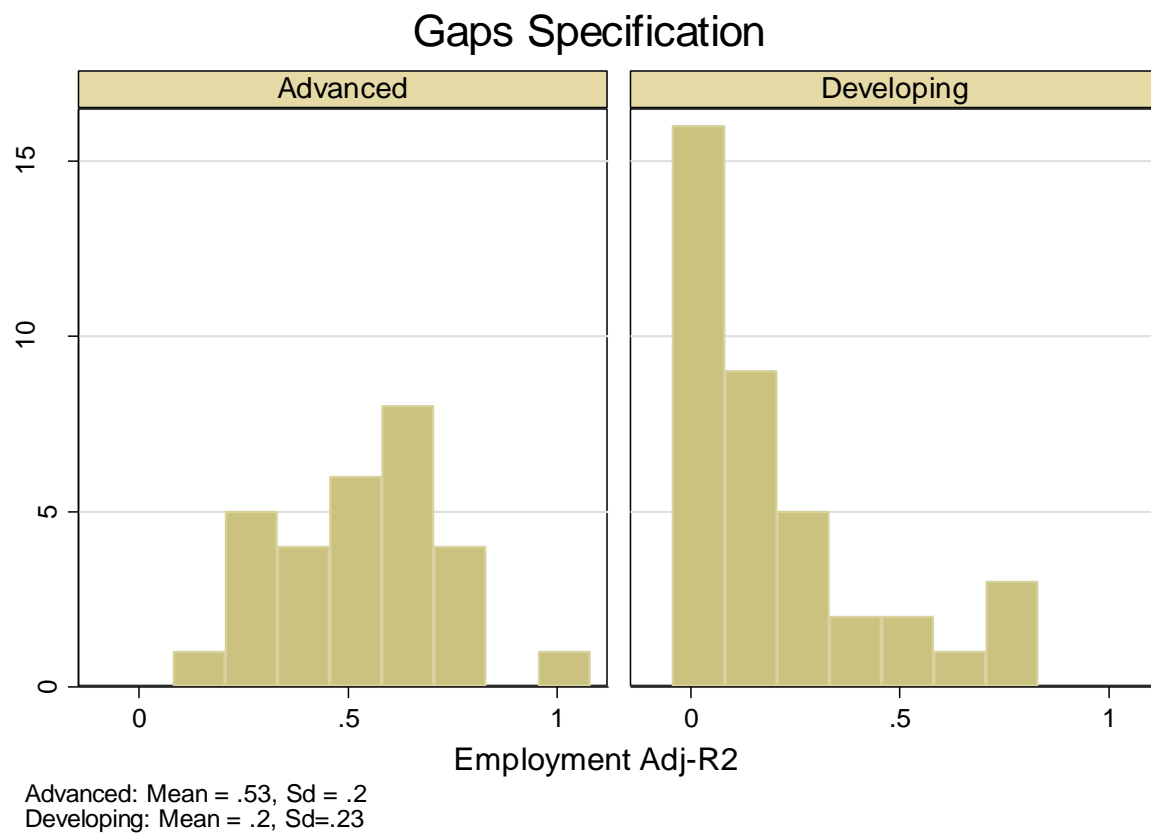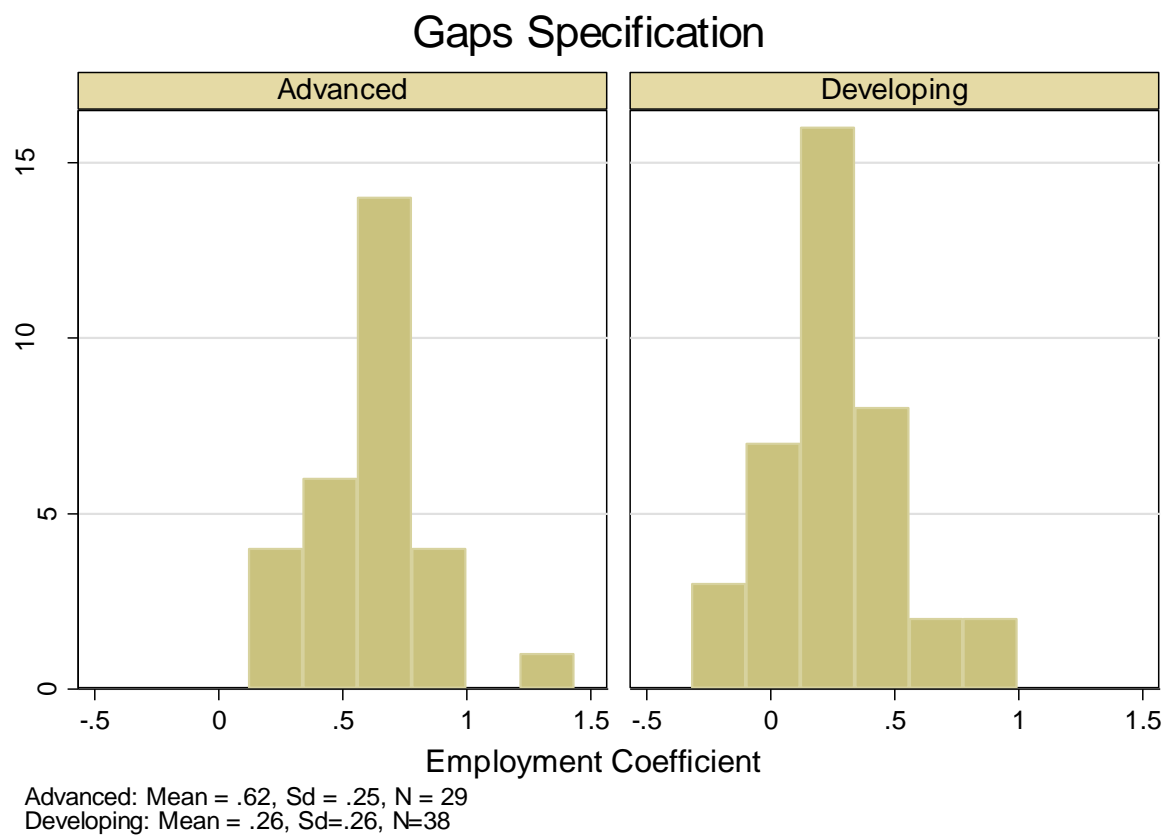
Figure 3: Labor force gap equations: Histograms of β^l estimates and $Adj\ R^2$

Gaps Specification

Labor Force Coefficient

Advanced: Mean = .18, Sd = .14, N = 29
Developing: Mean = .02, Sd=.2, N=38

Gaps Specification

Labor Force Adj-R2

Advanced: Mean = .17, Sd = .14
Developing: Mean = .09, Sd=.16
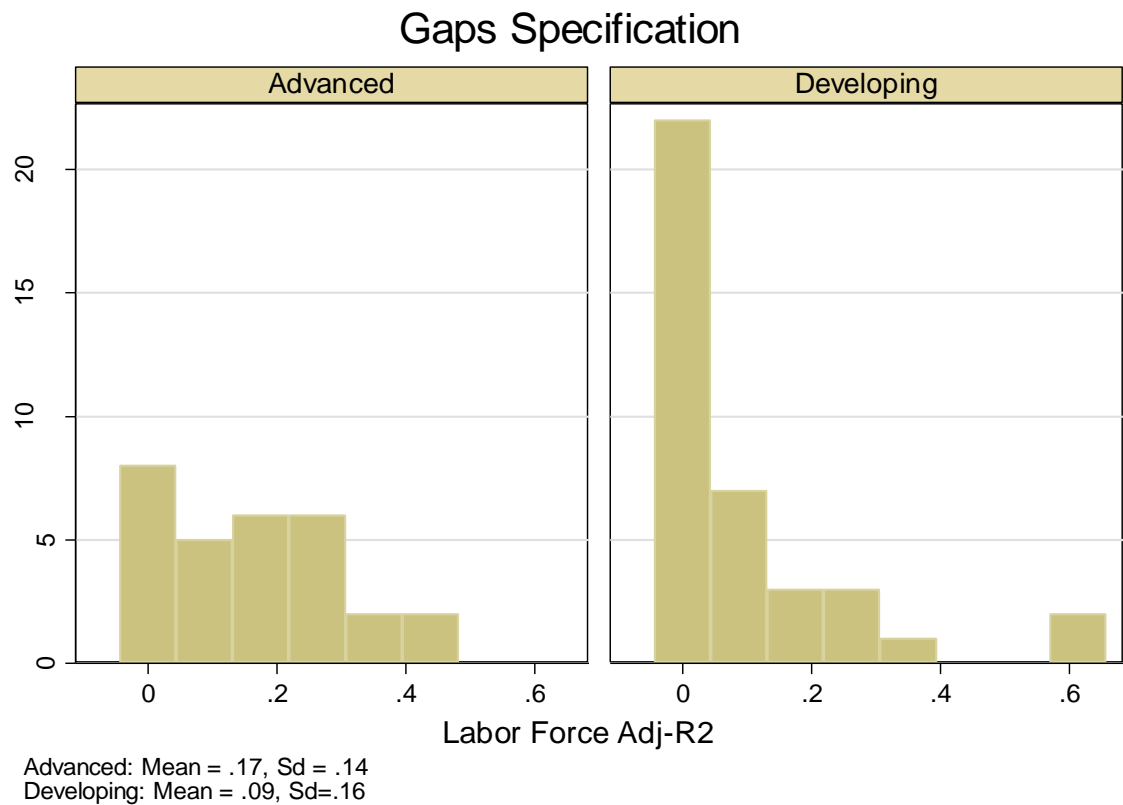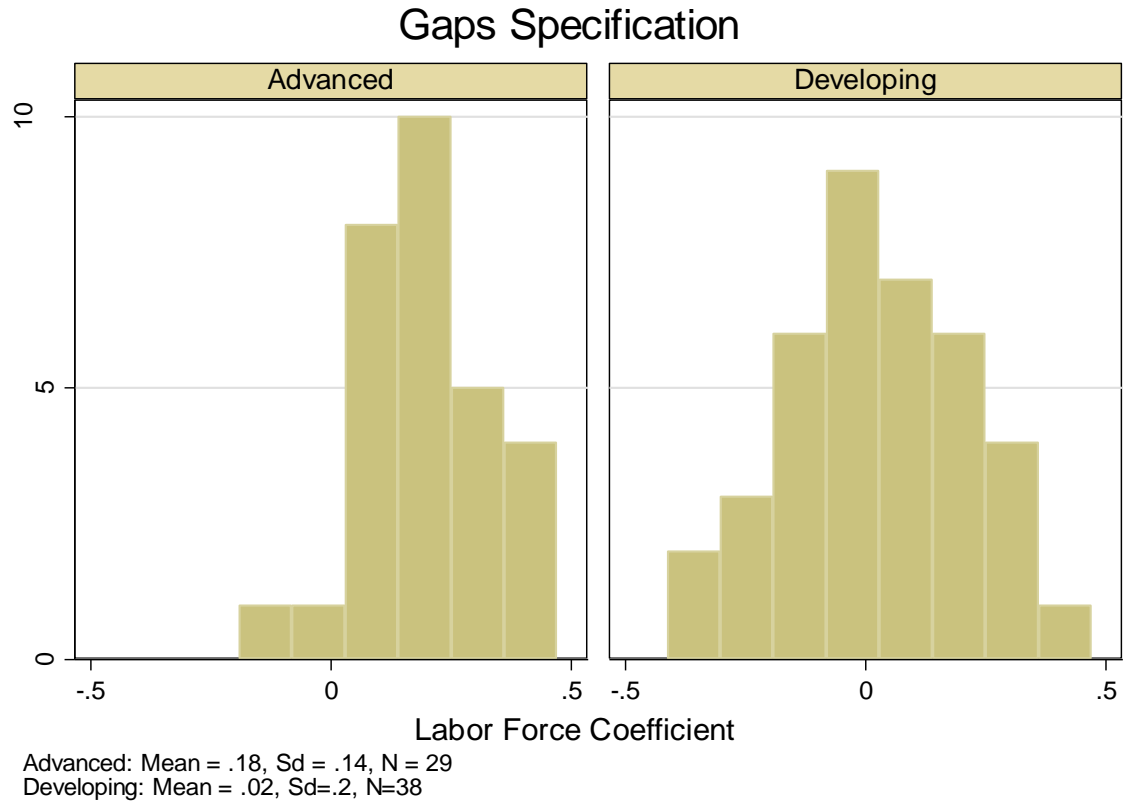
Figure 4: Change in unemployment equations: Histograms of γ estimates and $Adj\ R^2$

Changes Specification

Advanced: Mean = -.29, Sd = .15, N = 29
Developing: Mean = -.18, Sd=.12, N=41

Changes Specification

Advanced: Mean = .39, Sd = .19
Developing: Mean = .23, Sd=.21
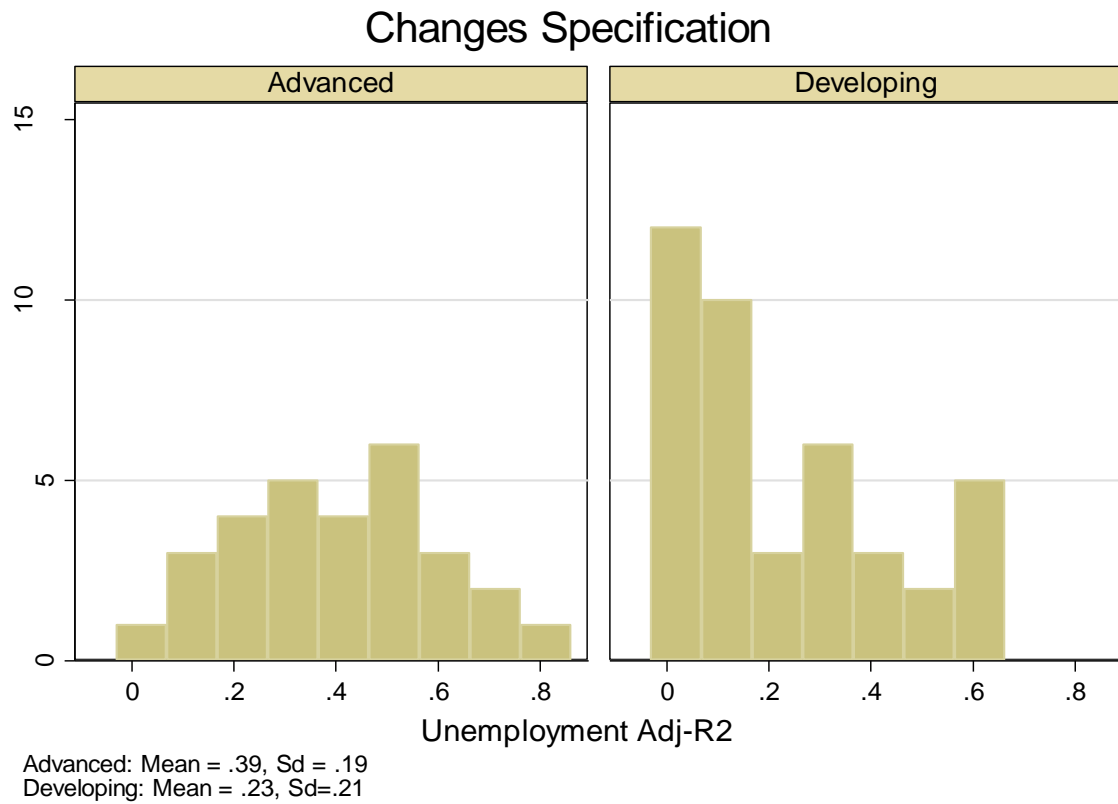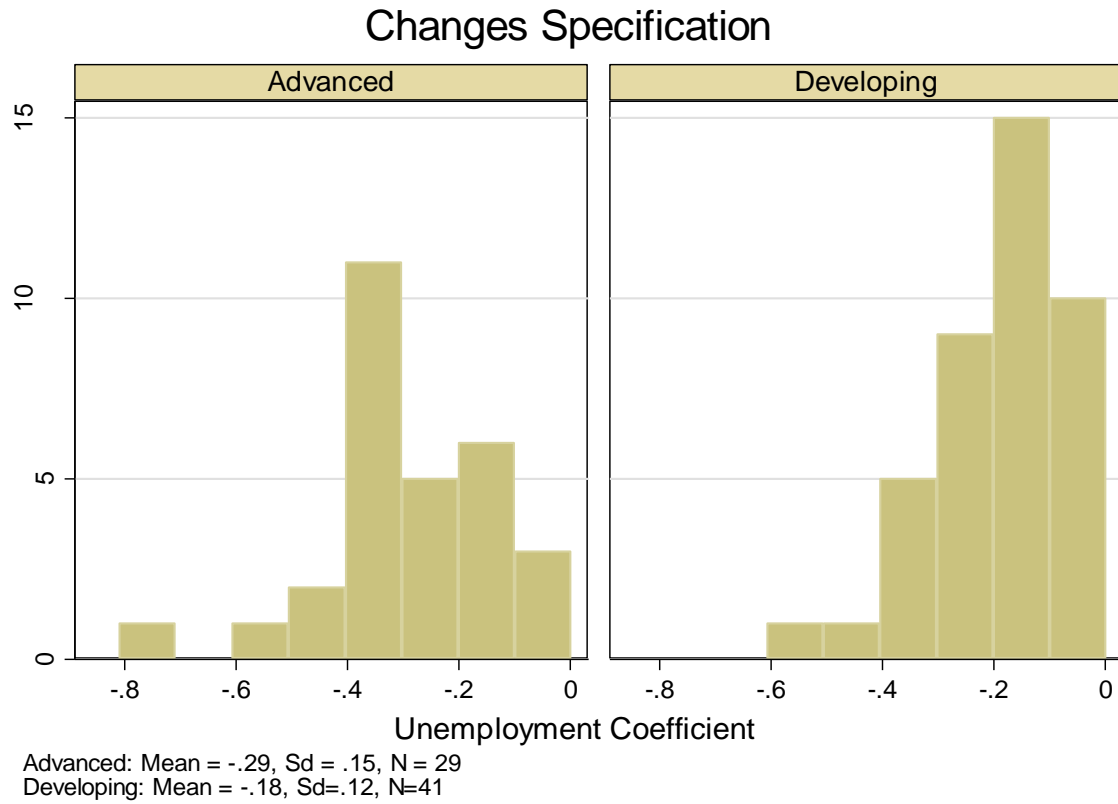
Figure 5: Employment growth equations: Histograms of γ^e estimates and $Adj\ R^2$

Advanced: Mean = .46, Sd = .23, N = 29
Developing: Mean = .22, Sd=.22, N=36

Advanced: Mean = .37, Sd = .2
Developing: Mean = .13, Sd=.22
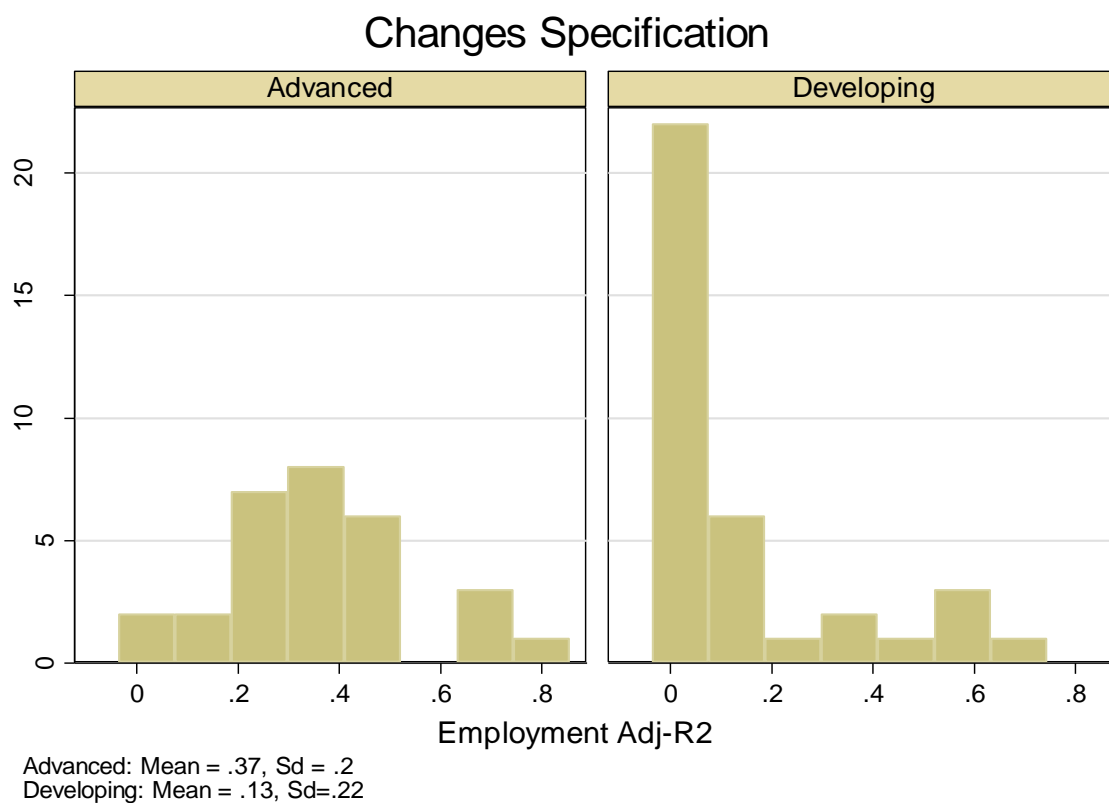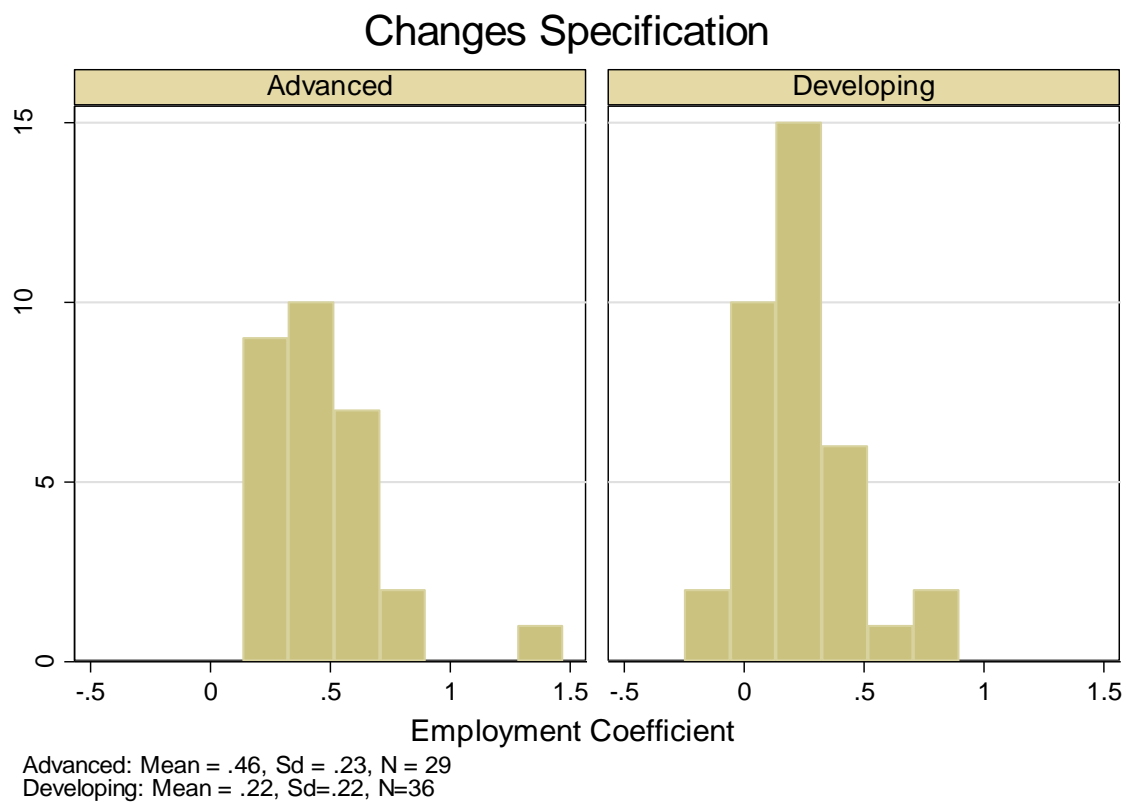
Figure 6: Labor force growth equations: Histograms of γ^l estimates and $Adj\ R^2$

Advanced: Mean = .14, Sd = .12, N = 29
Developing: Mean = .01, Sd=.19, N=36

Advanced: Mean = .1, Sd = .12
Developing: Mean = .05, Sd=.13

Figure 7: Country Cases: Colombia, Egypt, Poland and Russia

Figure 8: β vs average unemployment

Figure 9: β vs GDP per capita in thousands of 2010 dollars

Figure 10: β vs shadow economy
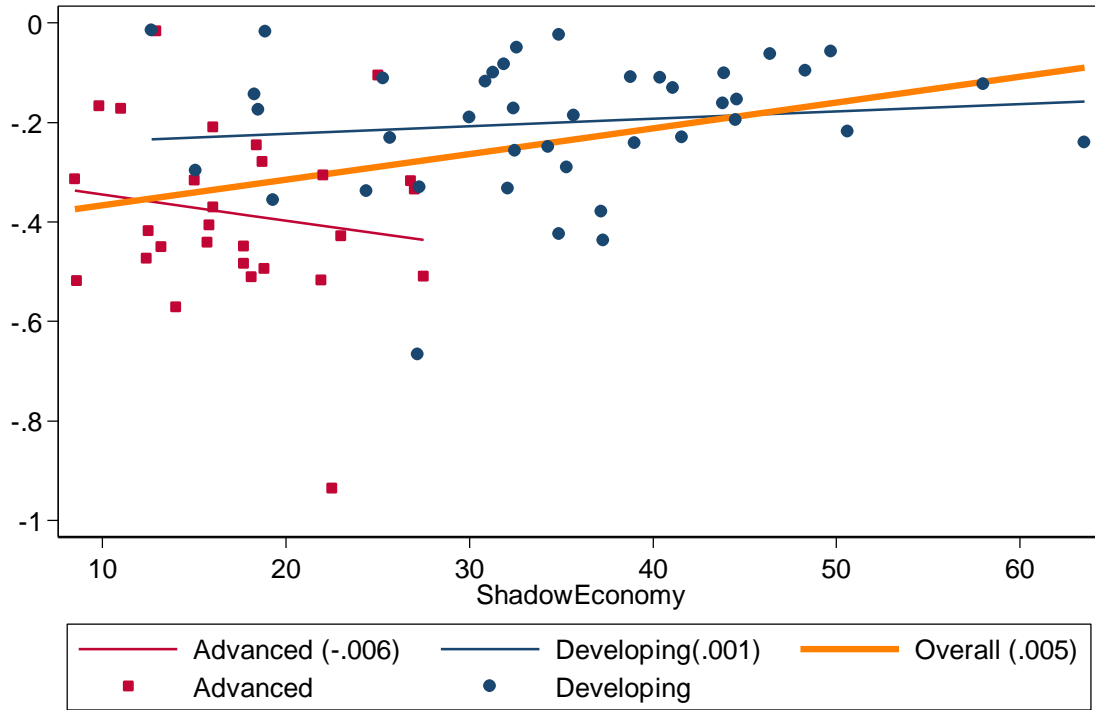
Figure 11: β vs Services as % of GDP
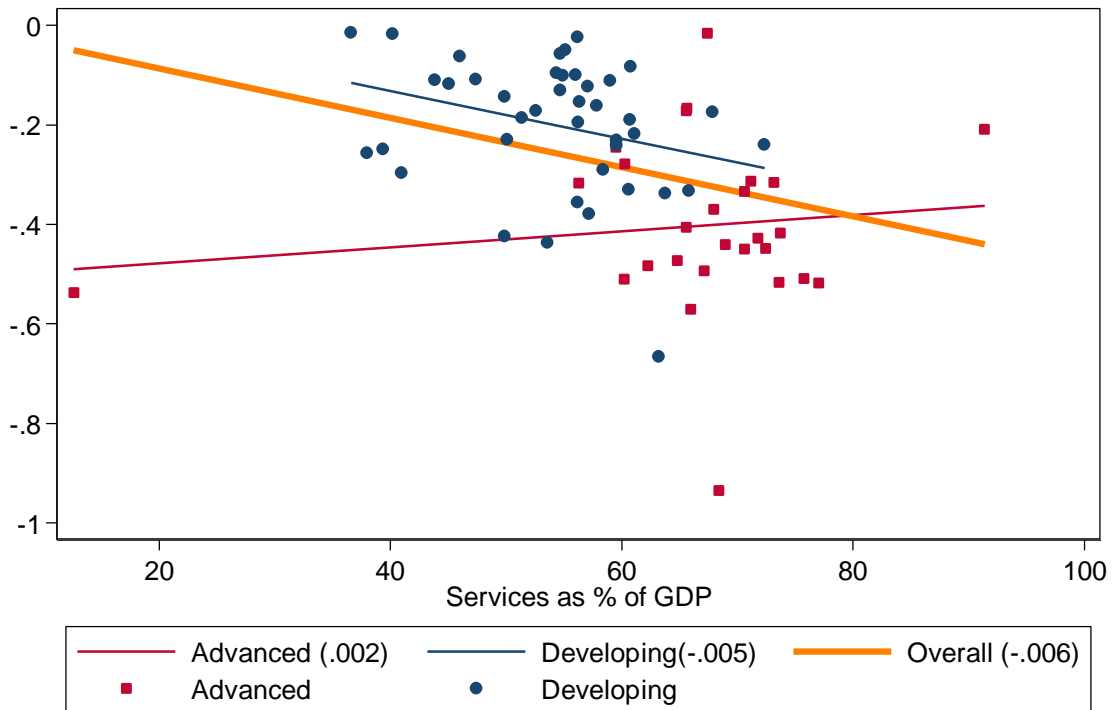
Figure 12: β vs skill mismatch index
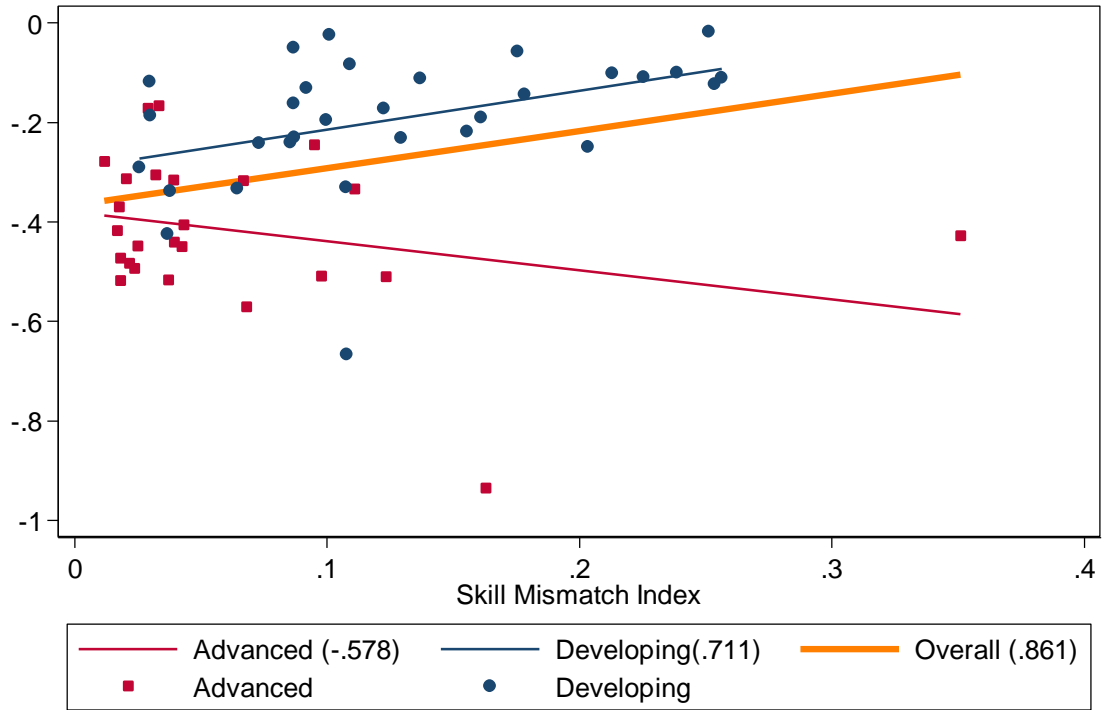
Figure 13: β vs labor market regulations
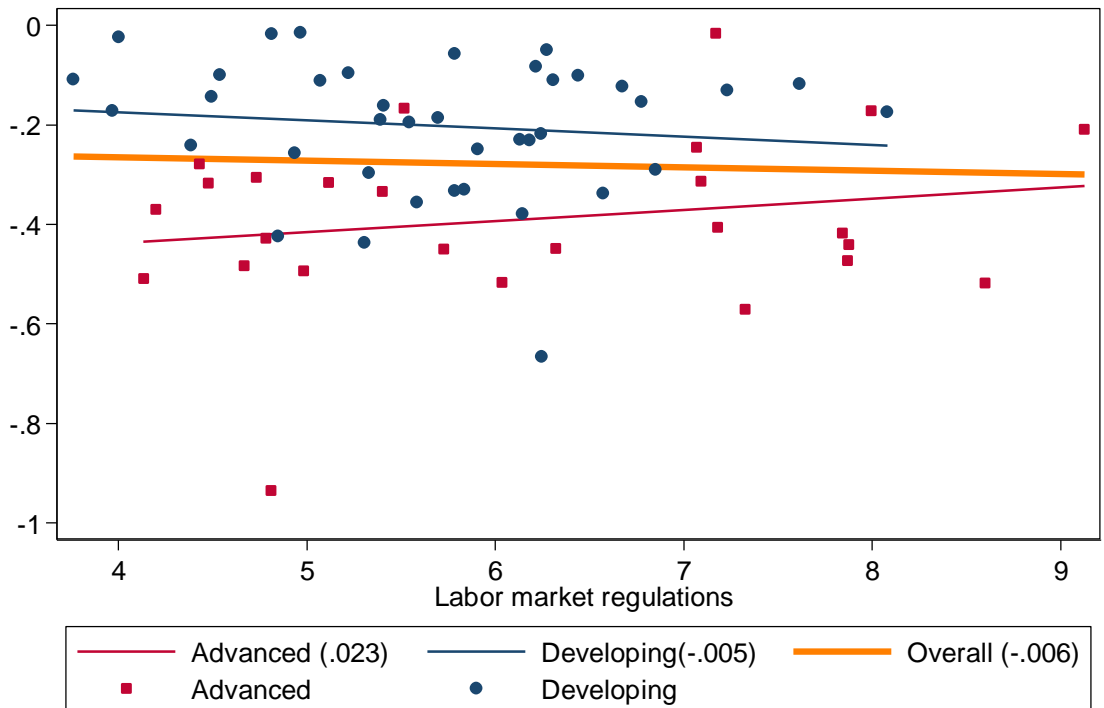
Figure 14: β vs business regulations
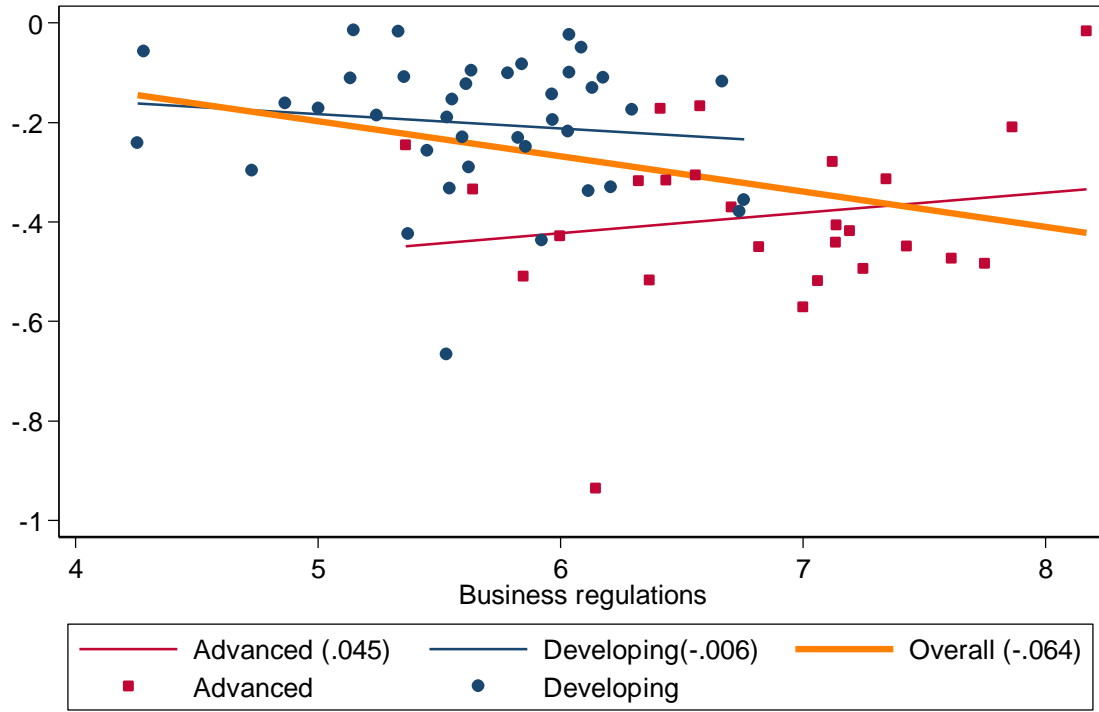
Table 1: Okun's law coefficients: Unemployment – Gaps specification

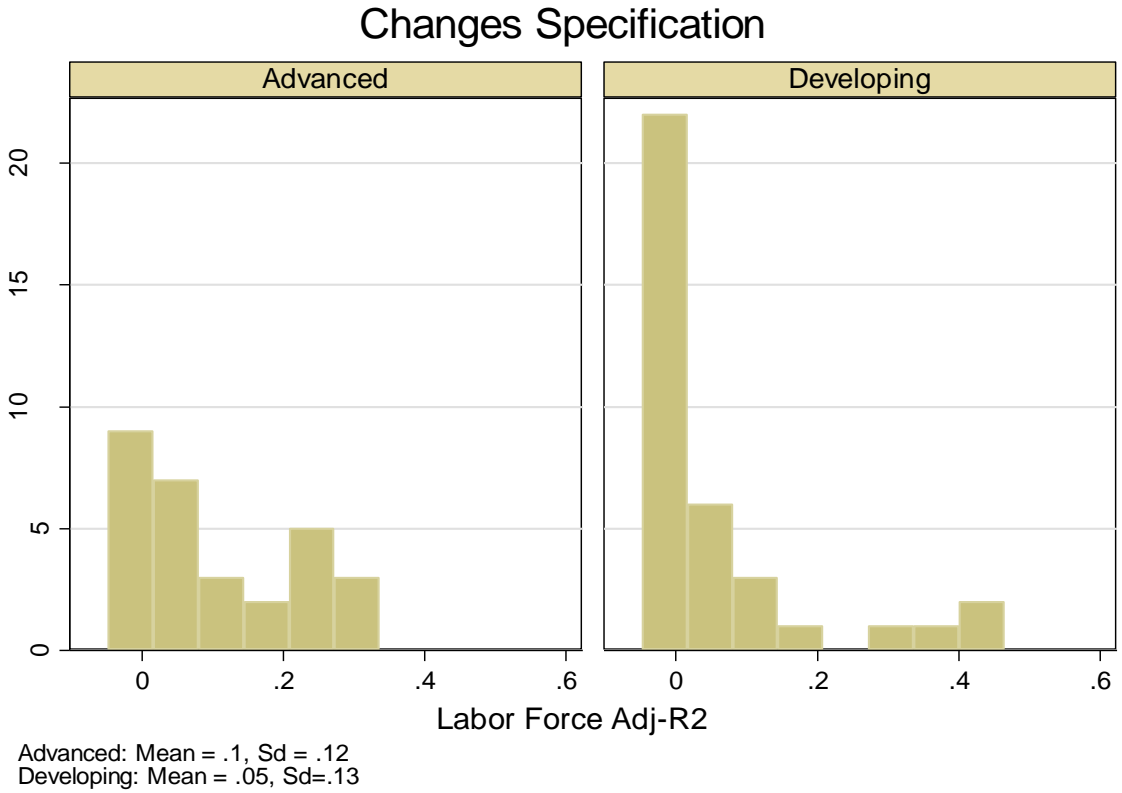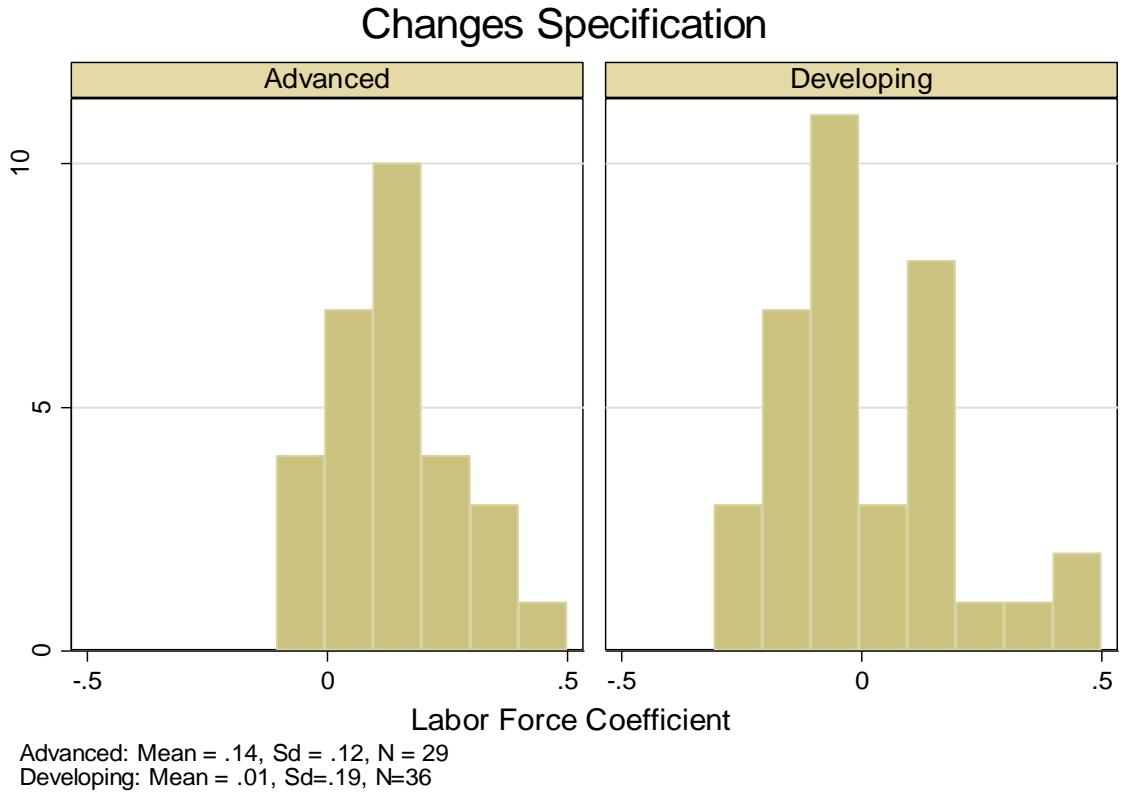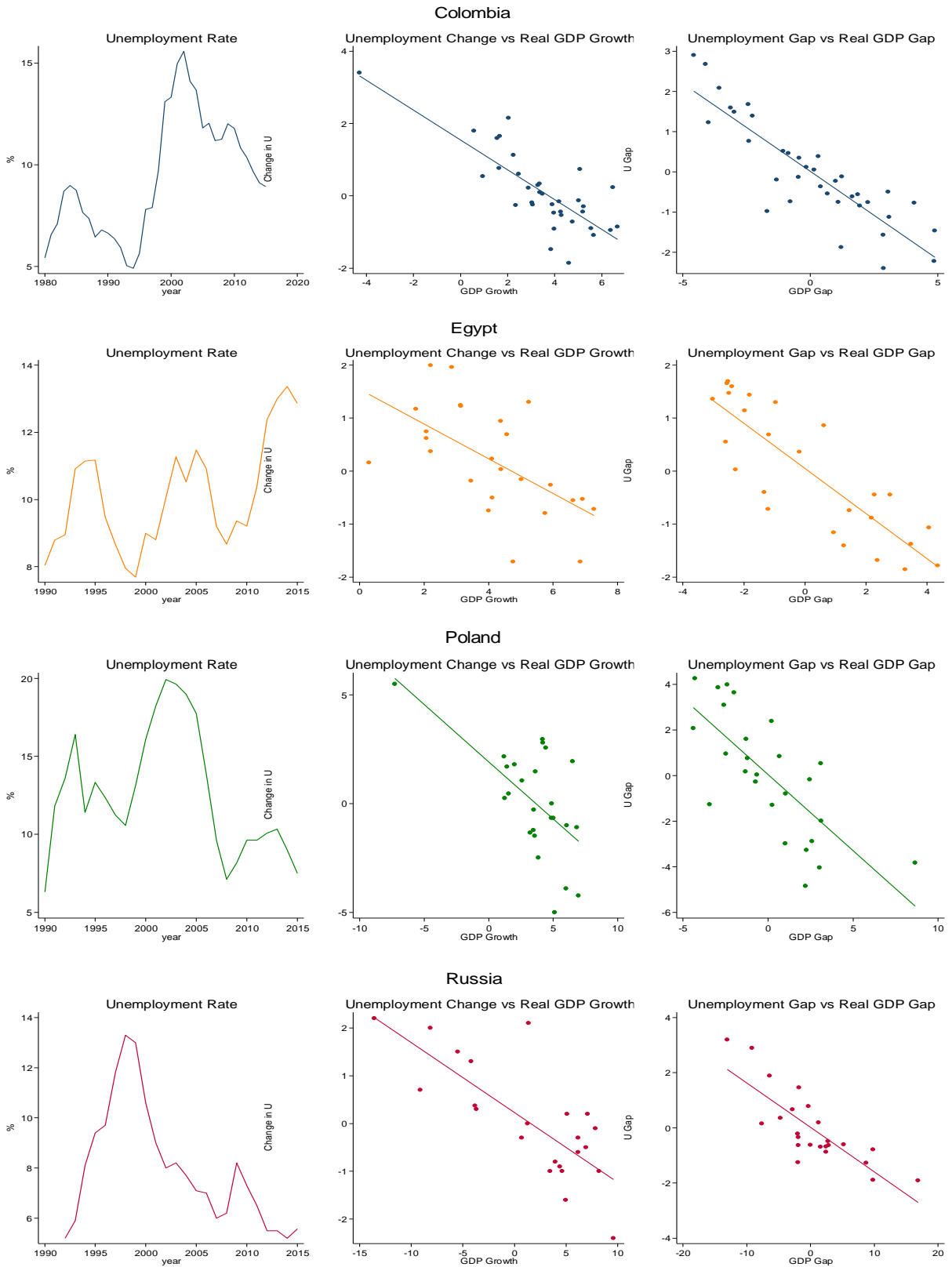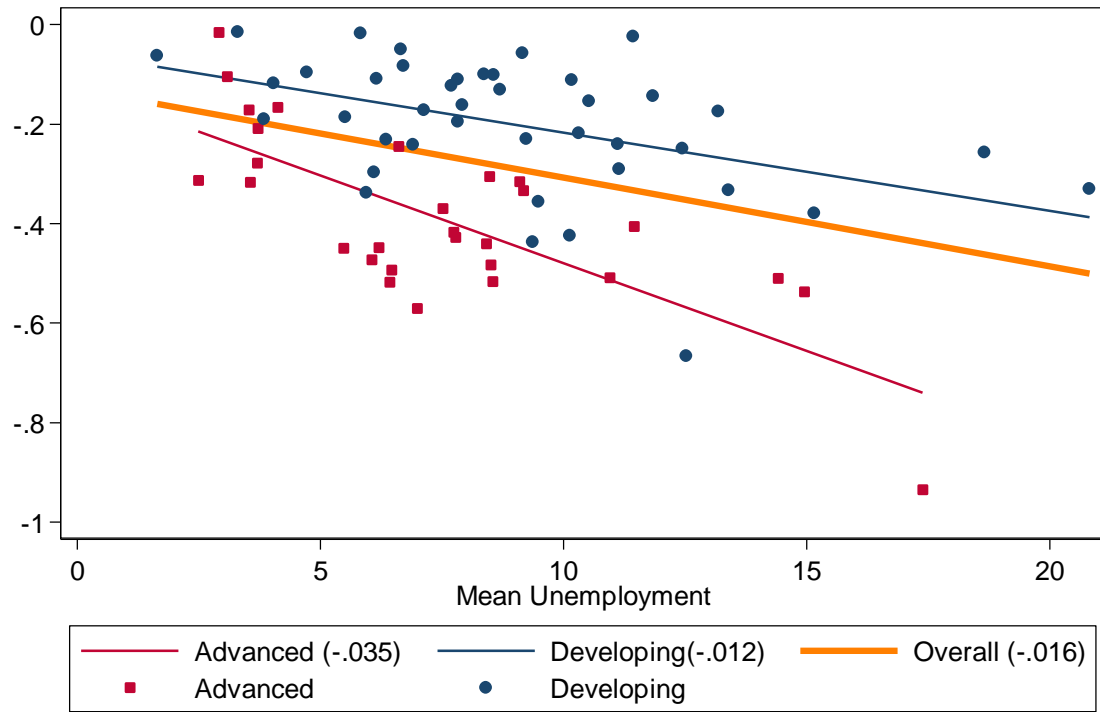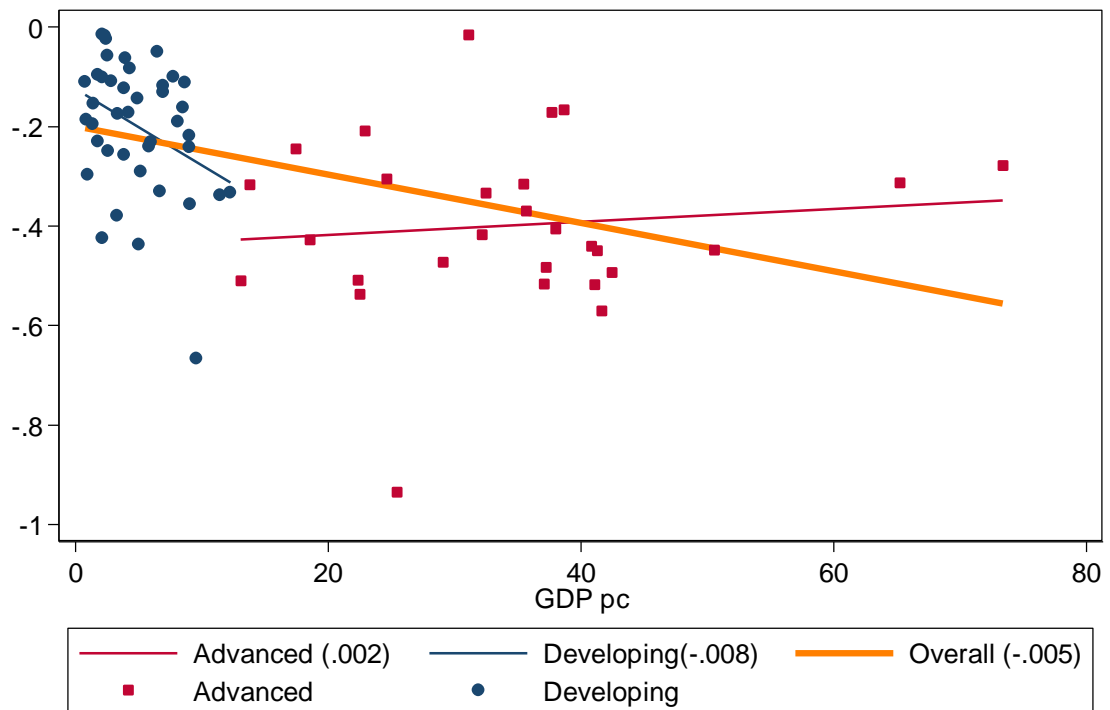| Country	β	Adj-R2	Country	β	Adj-R2
Australia	-0.570***	0.831	Albania	-0.249***	0.426
Austria	-0.166**	0.149	Algeria	-0.257**	0.108
Belgium	-0.516***	0.565	Argentina	-0.112**	0.093
Canada	-0.440***	0.771	Belarus	-0.062***	0.627
Czech Republic	-0.244***	0.552	Brazil	-0.241***	0.468
Denmark	-0.448***	0.652	Bulgaria	-0.291***	0.315
Finland	-0.482***	0.756	Chile	-0.356***	0.580
France	-0.315***	0.582	China	-0.015	-0.008
Germany	-0.370***	0.501	Colombia	-0.437***	0.751
Greece	-0.508***	0.820	Costa Rica	-0.231***	0.490
Hong Kong SAR	-0.209***	0.655	Croatia	-0.333***	0.391
Ireland	-0.406***	0.761	Dominican Republic	-0.084**	0.118
Israel	-0.306***	0.338	Ecuador	-0.172**	0.120
Italy	-0.334***	0.381	Egypt	-0.425***	0.696
Japan	-0.171***	0.694	Georgia	-0.015	-0.051
Korea	-0.317***	0.664	Honduras	-0.096*	0.064
Netherlands	-0.449***	0.706	Hungary	-0.338***	0.696
New Zealand	-0.473***	0.622	Indonesia	-0.017	-0.025
Norway	-0.278***	0.539	Iran	-0.144*	0.072
Portugal	-0.427***	0.690	Jordan	-0.175**	0.170
Puerto Rico	-0.537***	0.580	Kazakhstan	-0.131***	0.681
Singapore	-0.015	-0.019	Kyrgyz Republic	-0.110	0.029
Slovak Republic	-0.510***	0.804	Malaysia	-0.118***	0.443
Spain	-0.934***	0.827	Mexico	-0.190***	0.214
Sweden	-0.493***	0.570	Moldova	-0.195***	0.431
Switzerland	-0.313***	0.447	Morocco	-0.023	-0.039
Taiwan Province of China	-0.104***	0.380	Nicaragua	-0.154***	0.155
United Kingdom	-0.417***	0.637	Pakistan	-0.187***	0.272
United States	-0.518***	0.763	Panama	-0.241***	0.592
			Paraguay	-0.108*	0.074
			Peru	-0.123***	0.378
			Philippines	-0.230***	0.224
			Poland	-0.667***	0.522
			Romania	-0.049	0.027
			Russia	-0.161***	0.642
			South Africa	-0.330***	0.158
			Sri Lanka	-0.101***	0.338
			Tunisia	-0.379***	0.270
			Turkey	-0.100**	0.121
			Ukraine	-0.057*	0.112
			Uruguay	-0.218***	0.431
			Vietnam	-0.297**	0.159

Table 2: Okun's law coefficients: Employment – Gaps specification

	Advanced			Developing	
Country	β^e	Adj-R2	Country	β^e	Adj-R2
Australia	0.828***	0.547	Albania	0.411***	0.273
Austria	0.521***	0.332	Algeria	0.262	0.047
Belgium	0.615***	0.665	Argentina	0.186**	0.165
Canada	0.650***	0.749	Belarus	0.184***	0.340
Czech Republic	0.326***	0.591	Brazil	0.135*	0.054
Denmark	0.582***	0.415	Bulgaria	0.432**	0.171
Finland	0.726***	0.744	Chile	0.457***	0.521
France	0.416***	0.341	China	-0.035***	0.290
Germany	0.573***	0.664	Colombia	0.214	0.031
Greece	0.724***	0.691	Costa Rica	0.200	0.017
Hong Kong SAR	0.189**	0.127	Croatia	0.387***	0.256
Ireland	0.822***	0.791	Ecuador	0.415	0.018
Israel	0.713***	0.492	Egypt	0.829***	0.727
Italy	0.516***	0.525	Georgia	-0.244	0.023
Japan	0.245***	0.317	Honduras	0.246*	0.070
Korea	0.589***	0.505	Hungary	0.652***	0.629
Netherlands	0.646***	0.560	Indonesia	-0.036	-0.026
New Zealand	0.954***	0.700	Iran	0.313**	0.175
Norway	0.641***	0.359	Jordan	0.209***	0.330
Portugal	0.724***	0.591	Kazakhstan	0.422***	0.788
Puerto Rico	0.825***	0.346	Kyrgyz Republic	0.057	-0.033
Singapore	0.486***	0.322	Malaysia	0.121	0.024
Slovak Republic	0.439***	0.695	Mexico	0.279***	0.191
Spain	1.436***	0.957	Moldova	-0.033	-0.042
Sweden	0.640***	0.472	Morocco	-0.317*	0.105
Switzerland	0.470***	0.266	Nicaragua	0.524**	0.088
Taiwan Province of China	0.149***	0.272	Pakistan	0.340	0.048
United Kingdom	0.680***	0.652	Panama	0.259***	0.252
United States	0.722***	0.805	Peru	-0.026	-0.019
			Philippines	0.307**	0.160
			Poland	0.677***	0.460
			Russia	0.381***	0.776
			South Africa	0.835**	0.117
			Tunisia	0.326*	0.075
			Turkey	-0.159	0.004
			Ukraine	0.284***	0.350
			Uruguay	0.336***	0.175
			Vietnam	-0.089	-0.026

Table 3: Okun's law coefficients: Labor Force – Gaps specification

Country	β^{lf}	Adj-R2	Country	β^{lf}	Adj-R2
Australia	0.207**	0.092	Albania	0.111	0.027
Austria	0.347***	0.162	Algeria	-0.081	-0.020
Belgium	0.051	-0.009	Argentina	-0.088**	0.127
Canada	0.166***	0.228	Belarus	0.127**	0.216
Czech Republic	0.065*	0.126	Brazil	-0.124**	0.108
Denmark	0.104	0.015	Bulgaria	0.112	0.011
Finland	0.193***	0.394	Chile	0.049	0.008
France	0.069	-0.007	China	-0.050***	0.346
Germany	0.175***	0.283	Colombia	-0.276**	0.083
Greece	0.110*	0.077	Costa Rica	-0.048	-0.025
Hong Kong SAR	-0.030	-0.023	Croatia	0.006	-0.043
Ireland	0.368***	0.422	Ecuador	0.229	-0.018
Israel	0.373***	0.202	Egypt	0.356***	0.287
Italy	0.148**	0.103	Georgia	-0.259*	0.120
Japan	0.067	0.025	Honduras	0.147	0.022
Korea	0.257***	0.195	Hungary	0.290***	0.287
Netherlands	0.171***	0.169	Indonesia	-0.056	0.010
New Zealand	0.444***	0.416	Iran	0.148	0.048
Norway	0.352***	0.226	Jordan	0.006	-0.033
Portugal	0.256***	0.188	Kazakhstan	0.274***	0.658
Puerto Rico	0.171	0.019	Kyrgyz Republic	-0.064	-0.034
Singapore	0.471***	0.278	Malaysia	-0.003	-0.033
Slovak Republic	-0.157**	0.188	Mexico	0.081	-0.002
Spain	0.296***	0.298	Moldova	-0.035	-0.035
Sweden	0.110**	0.092	Morocco	-0.358**	0.155
Switzerland	0.148	0.002	Nicaragua	0.350	0.028
Taiwan Province of China	0.041	0.007	Pakistan	0.150	-0.015
United Kingdom	0.226***	0.371	Panama	-0.022	-0.026
United States	0.164***	0.293	Peru	-0.159***	0.173
			Philippines	0.053	-0.028
			Poland	-0.087	-0.014
			Russia	0.204***	0.577
			South Africa	0.405	0.023
			Tunisia	-0.119	-0.011
			Turkey	-0.270**	0.096
			Ukraine	0.223***	0.275
			Uruguay	0.088	-0.006
			Vietnam	-0.412*	0.110

Table 4: Okun's law coefficients: Unemployment – Changes specification

Advanced			Developing		
Country	γ	Adj-R2	Country	γ	Adj-R2
Australia	-0.508***	0.691	Albania	-0.154**	0.104
Austria	-0.136**	0.145	Algeria	-0.303**	0.113
Belgium	-0.337***	0.337	Argentina	-0.211***	0.324
Canada	-0.418***	0.763	Belarus	-0.056***	0.490
Czech Republic	-0.243***	0.352	Brazil	-0.188***	0.226
Denmark	-0.343***	0.505	Bulgaria	-0.248***	0.318
Finland	-0.345***	0.515	Chile	-0.400***	0.630
France	-0.237***	0.305	China	-0.002	-0.030
Germany	-0.230***	0.284	Colombia	-0.412***	0.614
Greece	-0.361***	0.583	Costa Rica	-0.226***	0.366
Hong Kong SAR	-0.168***	0.407	Croatia	-0.166**	0.136
Ireland	-0.341***	0.576	Dominican Republic	-0.064	0.030
Israel	-0.200**	0.139	Ecuador	-0.269*	0.085
Italy	-0.183***	0.201	Egypt	-0.328***	0.329
Japan	-0.070***	0.218	Honduras	0.003	-0.030
Korea	-0.159***	0.409	Hungary	-0.322***	0.628
Netherlands	-0.312***	0.507	Indonesia	-0.041	-0.008
New Zealand	-0.314***	0.260	Iran	-0.180**	0.140
Norway	-0.190***	0.268	Jordan	-0.141*	0.082
Portugal	-0.330***	0.467	Kazakhstan	-0.115***	0.490
Puerto Rico	-0.261***	0.217	Kyrgyz Republic	-0.119	0.055
Singapore	-0.012	-0.027	Malaysia	-0.105***	0.441
Slovak Republic	-0.349***	0.393	Mexico	-0.208***	0.440
Spain	-0.809***	0.698	Moldova	-0.239***	0.586
Sweden	-0.364***	0.468	Morocco	-0.042	-0.008
Switzerland	-0.259***	0.369	Nicaragua	-0.133**	0.123
Taiwan Province of China	-0.058**	0.156	Pakistan	-0.060	-0.010
United Kingdom	-0.367***	0.522	Panama	-0.226***	0.421
United States	-0.426***	0.632	Paraguay	-0.118	0.045
			Peru	-0.104**	0.117
			Philippines	-0.175**	0.121
			Poland	-0.527***	0.344
			Romania	-0.058	0.037
			Russia	-0.146***	0.576
			South Africa	-0.249*	0.061
			Sri Lanka	-0.067**	0.168
			Tunisia	-0.337***	0.230
			Turkey	-0.114***	0.214
			Ukraine	-0.040	-0.012
			Uruguay	-0.204***	0.318
			Vietnam	-0.169	-0.001

Table 5: Okun's law coefficients: Employment – Changes specification

Advanced			Developing		
Country	γ^e	Adj-R2	Country	γ^e	Adj-R2
Australia	0.631***	0.413	Albania	0.159	0.009
Austria	0.309***	0.244	Algeria	0.084	-0.027
Belgium	0.394***	0.344	Argentina	0.230**	0.147
Canada	0.599***	0.734	Belarus	0.228***	0.613
Czech Republic	0.234**	0.217	Brazil	0.093	-0.006
Denmark	0.450***	0.293	Bulgaria	0.448***	0.309
Finland	0.538***	0.515	Chile	0.459***	0.495
France	0.212*	0.074	China	0.019	-0.030
Germany	0.333***	0.346	Colombia	0.300	0.039
Greece	0.562***	0.388	Costa Rica	0.048	-0.028
Hong Kong SAR	0.213***	0.235	Croatia	0.166	-0.003
Ireland	0.743***	0.688	Ecuador	0.271	-0.032
Israel	0.425***	0.211	Egypt	0.864***	0.656
Italy	0.252***	0.251	Honduras	-0.020	-0.030
Japan	0.251***	0.500	Hungary	0.554***	0.407
Korea	0.364***	0.481	Indonesia	-0.029	-0.036
Netherlands	0.516***	0.427	Iran	0.184	0.038
New Zealand	0.635***	0.377	Jordan	0.205***	0.219
Norway	0.351**	0.140	Kazakhstan	0.456***	0.624
Portugal	0.578***	0.413	Kyrgyz Republic	0.052	-0.024
Puerto Rico	0.733***	0.399	Malaysia	0.249**	0.146
Singapore	0.346**	0.157	Mexico	0.169	0.047
Slovak Republic	0.315**	0.225	Moldova	0.143	-0.007
Spain	1.282***	0.857	Nicaragua	0.311	0.009
Sweden	0.474***	0.340	Pakistan	-0.247	-0.023
Switzerland	0.235*	0.062	Panama	0.221**	0.105
Taiwan Province of China	0.161***	0.308	Peru	0.043	-0.013
United Kingdom	0.495***	0.396	Philippines	0.088	-0.023
United States	0.630***	0.736	Poland	0.419**	0.170
			Russia	0.351***	0.623
			South Africa	0.752*	0.066
			Tunisia	0.243	0.046
			Turkey	-0.110	-0.010
			Ukraine	0.231**	0.162
			Uruguay	0.346**	0.103
			Vietnam	0.072	-0.033

Table 6: Okun's law coefficients: Labor force – Changes specification

Advanced			Developing		
Country	γ^{lf}	Adj-R2	Country	γ^{lf}	Adj-R2
Australia	0.080	-0.004	Albania	-0.026	-0.028
Austria	0.166*	0.080	Algeria	-0.306	0.026
Belgium	0.027	-0.027	Argentina	-0.160*	0.131
Canada	0.140***	0.171	Belarus	0.169***	0.465
Czech Republic	-0.024	-0.042	Brazil	-0.109	0.030
Denmark	0.085	-0.005	Bulgaria	0.177**	0.151
Finland	0.161***	0.228	Chile	-0.004	-0.030
France	-0.048	-0.022	China	0.019	-0.035
Germany	0.086*	0.061	Colombia	-0.161	-0.005
Greece	0.129	0.018	Costa Rica	-0.195	0.008
Hong Kong SAR	0.038	-0.016	Croatia	-0.022	-0.047
Ireland	0.356***	0.319	Ecuador	-0.024	-0.040
Israel	0.204	0.028	Egypt	0.499***	0.277
Italy	0.050	-0.010	Honduras	-0.016	-0.030
Japan	0.179***	0.311	Hungary	0.210**	0.102
Korea	0.198***	0.303	Indonesia	-0.073	0.003
Netherlands	0.188**	0.128	Iran	-0.022	-0.042
New Zealand	0.295***	0.219	Jordan	0.042	-0.027
Norway	0.155	0.040	Kazakhstan	0.326***	0.463
Portugal	0.216**	0.088	Kyrgyz Republic	-0.080	-0.024
Puerto Rico	0.410***	0.235	Malaysia	0.138	0.032
Singapore	0.335**	0.124	Mexico	-0.049	-0.023
Slovak Republic	-0.090	-0.009	Moldova	0.139	0.016
Spain	0.299***	0.235	Nicaragua	0.162	-0.018
Sweden	0.081	0.028	Pakistan	-0.307	-0.012
Switzerland	-0.031	-0.028	Panama	-0.042	-0.024
Taiwan Province of China	0.100***	0.175	Peru	-0.069	-0.007
United Kingdom	0.097	0.039	Philippines	-0.105	-0.016
United States	0.170***	0.255	Poland	-0.175	0.019
			Russia	0.191***	0.338
			South Africa	0.439	0.032
			Tunisia	-0.158	0.015
			Turkey	-0.236*	0.074
			Ukraine	0.190*	0.100
			Uruguay	0.113	-0.014
			Vietnam	-0.114	-0.033

Table 7: Classification of countries by Fit of Okun's Law

		Adj R2		
		Smaller than developing countries average	Higher than developing countries average but smaller than advanced countries average	Higher than advanced countries average
β	Higher than advanced countries average (in absolute value)		Poland	Colombia, Egypt
	Higher than developing countries average but smaller than advanced countries average (in absolute value)	Algeria, Philippines, South Africa, Tunisia, Vietnam	Albania, Brazil, Bulgaria, Chile, Costa, Rica, Croatia, Panama, Uruguay	Hungary
	Smaller than developing countries average (in absolute value)	Argentina, China, Dominican Republic, Ecuador, Georgia, Honduras, Indonesia, Iran, Jordan, Kyrgyz Republic, Mexico, Morocco, Nicaragua, Pakistan, Paraguay, Romania, Turkey, Ukraine	Malaysia, Moldova, Peru, Sri Lanka	Belarus, Kazakhstan, Russia

Table 8: Determinants of the Okun Coefficients

	β			β^e		
GDP pc (1000's)	-0.0019	0.0001		0.0042	0.0005	
	(0.0019)	(0.0021)		(0.0037)	(0.0039)	
Services as % of GDP	-0.0070**	-0.0104***	-0.0124***	0.0060	0.0105*	0.0179***
	(0.0028)	(0.0031)	(0.0019)	(0.0051)	(-0.0054)	(0.0039)
Shadow Economy	0.0019	0.0025		-0.0037	-0.0051	
	(0.0022)	(0.0026)		(0.0043)	(0.0067)	
Skill Mismatch Index	0.1804	0.1697		-0.3870	-0.3320	
	(0.2728)	(0.3150)		(0.5270)	(0.5810)	
Business Regulations	-0.0199	-0.0213		0.0492	0.0482	
	(0.0321)	(0.0370)		(0.0605)	(0.0669)	
Labor Market Regulations	0.0064	0.0162		0.0062	-0.0106	
	(0.0166)	(0.0190)		(0.0320)	(0.0349)	
Mean Unemployment	-0.0228***		-0.0178***	0.0348***		0.0226**
	(0.0055)		(0.0052)	(0.0103)		(0.0101)
Constant	0.3708	0.2733	0.6029***	-0.4910	-0.2690	-0.8341***
	(-0.2490)	(0.2860)	(0.1256)	(0.4750)	(0.5200)	(0.2555)
Observations	56	56	56	54	54	54
R-squared	0.58	0.42	0.50	0.48	0.349	0.33
Adjusted R-squared	0.52	0.35	0.48	0.40	0.266	0.31

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Appendix

Table A1

Advanced		Developing	
Australia	Korea	Albania	Kyrgyz Republic(1994)
Austria	Netherlands	Algeria	Malaysia(1985)
Belgium	New Zealand	Argentina	Mexico
Canada	Norway	Belarus(1991)	Moldova(1993)
Czech Republic(1995)	Portugal	Brazil	Morocco(1995)
Denmark	Puerto Rico	Bulgaria(1989)	Nicaragua
Finland	Singapore	Chile	Pakistan(1983)
France	Slovak Republic(1993)	China	Panama
Germany	Spain	Colombia	Paraguay(1983)
Greece	Sweden	Costa Rica	Peru
Hong Kong SAR	Switzerland	Croatia(1992)	Philippines(1985)
Ireland(1985)	Taiwan Province of China	Dominican Republic(1991)	Poland(1990)
Israel	United Kingdom	Ecuador(1988)	Romania(1985)
Italy	United States	Egypt(1990)	Russia(1992)
Japan		Georgia(1996)	South Africa
		Honduras	Sri Lanka(1990)
		Hungary	Tunisia(1990)
		Indonesia(1984)	Turkey
		Iran(1990)	Ukraine(1995)
		Jordan(1984-2014)	Uruguay(1983)
		Kazakhstan(1994)	Vietnam(1990)

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