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Macroeconomic Determinants of Performed Operas: A Multi-Country Study 2014-2018

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Abstract: The analysis of a quarterly panel of ten countries covering 75 percent of the worldwide opera performances through the years 2014 to 2018 showed that the number of performances depend positively on growth and strongly negatively on unexpected inflation. Furthermore, highly significant country effects correspond with the differing operational procedures of opera houses, while a time effect indicates a negative trend of the number of performances. By contrast, the share of most important composers in the performances seems to be rather stable: there is no significant dependence on growth and inflation and very weak time effects exist. However, we find strong country differences in the share of composers' work performed. There is mostly a home bias and some of the cross-country patterns have historical roots.

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1 Introduction

Performing operas is a very special form of economic activity in several respects[1]. Firstly, the production of live opera performances does not benefit from labor-saving technical progress. Today we need the same size orchestra, chorus and numbers of singers to produce for instance Verdis's Don Carlos as in 1867 when it was first performed. This is in strong contrast to most other sectors of the economy which are subject to a trend growth of labor productivity between one and two percent per annum. There is some slight room for enlarging the audience, as through international transmission into cinemas, in order to make live performance more productive. Secondly, general economic growth can make opera production more lucrative by increasing the willingness to pay for it, which may then lead then to more production with higher prices. Third, the operation of opera houses is often financed in a mixed way, namely by sales of tickets, private sponsorship and public subsidies. All these points suggest that, despite the absence of labor saving technical progress, there is a dependence of opera performances on macroeconomic conditions: growth may increase the demand for performances, and the funds available to opera houses and unexpected inflation may lower the real value of budgets usually fixed in nominal terms for longer periods.

This paper provides an empirical analysis of the relationship between growth, inflation and the number of opera performances. We use a quarterly panel data set consisting of ten countries covering the period 2014 to 2018. The countries considered are the most important ones with respect to opera and generate 75 percent of opera productions worldwide. Besides the aggregate effect, we also look at the share of the seven most performed composers. We ask if they are independent of macroeconomic conditions and how do they vary across countries and time?

The paper is organized as follows. Section 2 discusses the data on the total number of opera performances. The data are linked to GDP growth and inflation using panel regression methods with country and time effects in section 3. The same model is then used to analyze seven composers' shares in section 4. Section 5 concludes.

[1] The classic reference on the economics of the performing arts is Baumol and Bowden (1967). Scherrer (2005) and Velde (2015) discuss specifically classical music and opera, respectively.

2. Number of performances in 10 countries 2014-2018

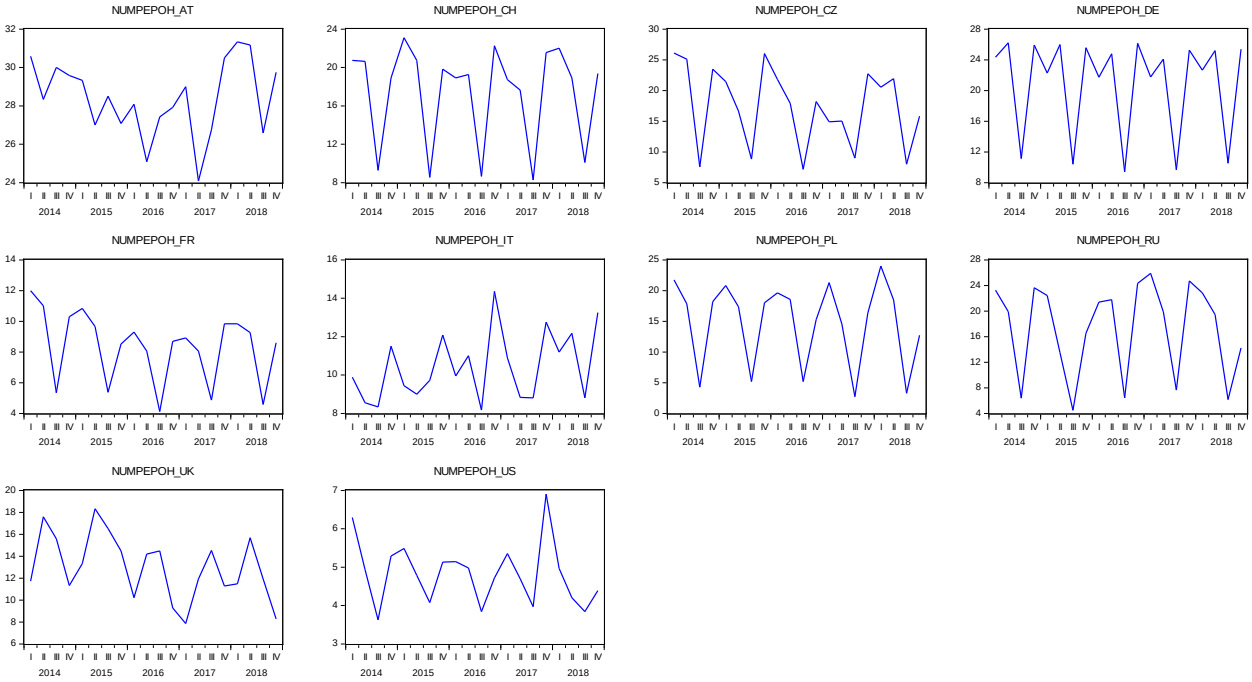
In this section, we provide an empirical analysis of the quarterly number of operas in ten countries, namely Austria (AU), Switzerland (CH), Czech Republic (CZ), Germany (DE), France (FR), Italy (IT), Poland (PL), Russia (RU), UK and US. These countries were the most important providers of operas during the period 2014-2018. They accounted for 75% of all opera performances worldwide reported on the website "operabase" (http://operabase.com/index.cgi?lang=en). The total number of performances varies widely between countries. This mainly reflects the population size and the level of economic development of countries and, in particular, the number of opera houses or companies. The top numbers are reported for US and Germany (93 and 91, respectively), France and Italy have 35 and 36 opera houses, respectively, Russia 26, whereas for the small countries Austria, Switzerland and Czech Republic as well as for Poland the number of opera houses lies in the narrow range between 11 and 12. Therefore, we focus our analysis on the number of performances per opera house or company.

Quarterly data from 2014/I to 2018/IV are displayed in Figure 1. Firstly, we see a stationary development with a very strong seasonal pattern: the unconditional mean appears constant for all countries, and in seven out of ten countries, we have a strong seasonal low in the third quarter. The exceptions to this rule are Austria, Italy and the UK. Secondly, we note striking differences in the mean number of performances differences across countries. The maximum is for Austria with nearly 30 performances per quarter, whereas the minimum holds for the US with only approximately five quarterly performances on average.

How can we explain these patterns? The seasonal low is easy to explain as most opera houses are completely or partially closed in two summer months before the start of the new season. The differing results for Austria, Italy and UK are probably caused by the festivals held during the summer months in these countries, such as Salzburg and Verona to name only the most well-known ones. The difference of the average number of performances is explained by the way opera houses are managed. The opera houses in the German speaking area as well as in the Czech Republic mostly have a "repertoire" system with a dense pattern of performances over the

entire season. In other countries we have more often a ”stagione” system where only a relative small number of series of five to six performances per opera are offered. In the second panel of Figure 1 we display seasonally adjusted series (census x-12 method). Removing the strong seasonal pattern shows some slight trend pattern in some countries: in the Czech Republic, Germany France and UK we note declining number of performances whereas for Austria and Italy we observe an increasing trend over the five years considered. Nevertheless, these patterns are consistent with the assumption of stationary series. The panel unit root test of Im, Pesaran and Shin results in a W-test statistic equal to 4.826, which rejects the unit root hypothesis at all reasonable significance levels. For our econometric analysis, we use the seasonally adjusted data, which correspond to the seasonally adjusted macroeconomic data series[2].

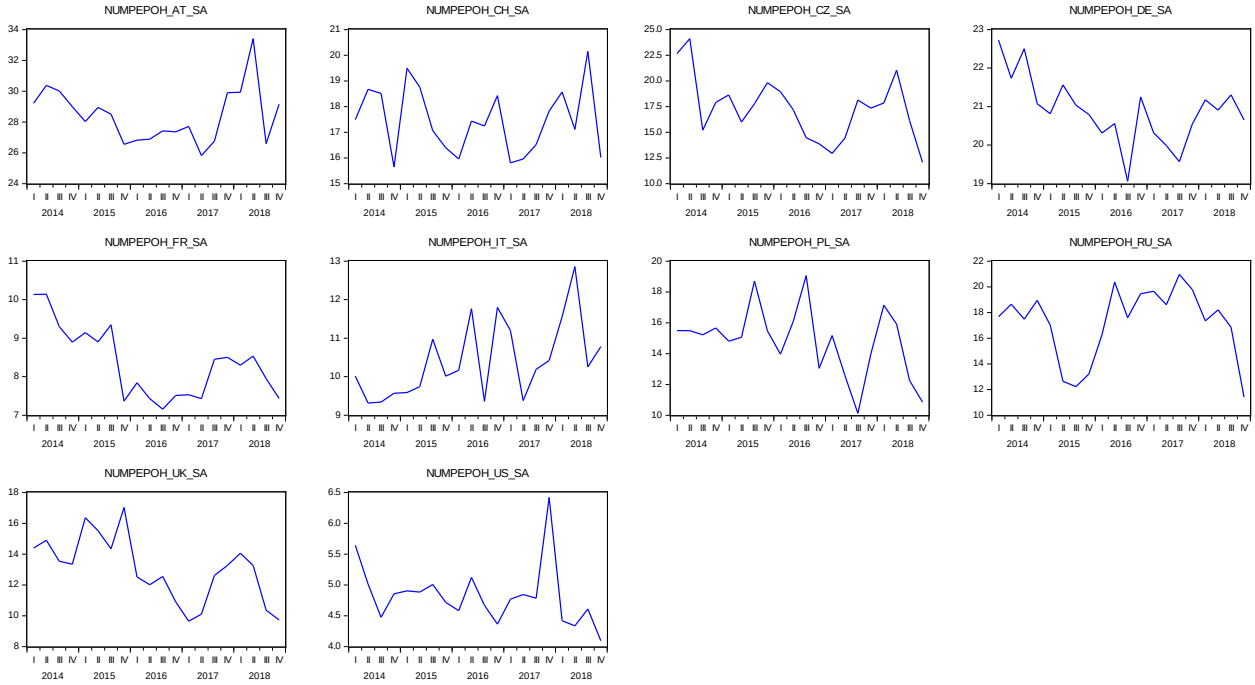
Figure 1: Number of performances per opera house, quarterly 2014-2018 10 countries



Data source: http://operabase.com/oplist.cgi?lang=en&ask=t

[2] Alternatively, we could use unadjusted series and include three seasonal dummy variables in our regression. As the seasonal pattern is different, across countries we have to include country specific seasonal variables and the number of estimated coefficients becomes rather large. This approach results in less precise estimates, which are, however, not strongly different from those obtained with seasonally adjusted data.

Seasonally adjusted



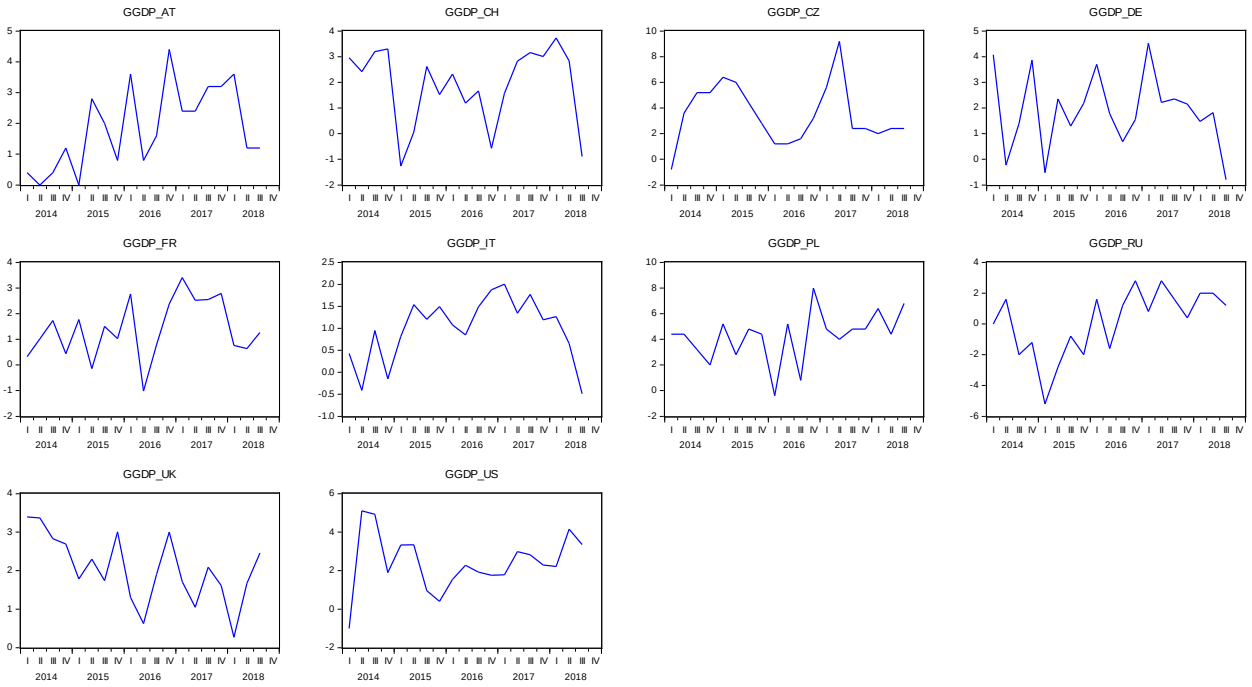
3. The impact of macroeconomic development on the number of opera performances

Figure 2 and 3 display the quarterly pattern of the two main macroeconomic seasonally adjusted indicators, (real) GDP growth and inflation, over the period 2014-2018. Interestingly, growth in three countries (Austria, Italy and UK) exhibits a similar pattern as the number of performances plotted in Figure 1. This suggests a positive relationship between growth (GGDP) and the number of performances per opera house (NUMPE). In addition, we note a tendency to rising inflation (INF) in the Czech Republic and in France, which suggests a negative relationship between this indicator and NUMPE. A priori, a positive relationship between growth and the number of performances makes sense: opera houses finance their activities by sales of tickets, private sponsoring and public subsidies. All these funds tend to rise with an increase in the economic growth. A negative influence of inflation is plausible, too, as the sizeable portion of opera houses' budget (subsidies and sponsorships) are fixed in nominal terms. Unexpectedly rising inflation then means shrinking of the real value of available financial means and thus may

result in fewer performances. It is unexpected inflation, which matters in this context, as it is reasonable to assume that budgets cover expected changes in inflation. Moreover, unexpected inflation may also reduce the number of performances from the demand side of the public: it may reduce real disposable income, which results in less demand for performances and reduced funds from ticket sales.

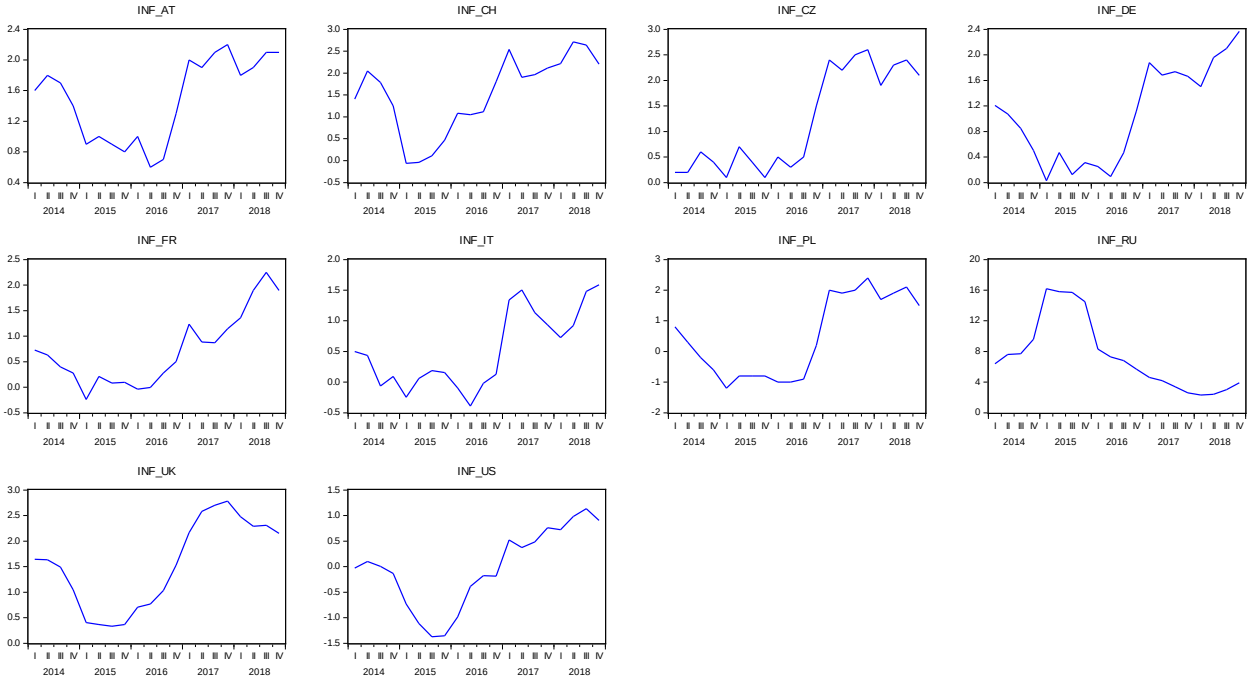
Note that there may exist a reversed relationship between opera production and economic growth in the long run: opera production may attract high-human-capital employees in other industries who increase productivity in a region with an opera house. Data for German regions support this hypothesis (Falck, Fritsch and Heblich, 2010). However, our short run quarterly data hardly reflect such a long run relationship.

Figure 2: Real GDP, annualized rate of change (%), quarterly 2014-2018, seasonally adjusted, 10 countries



Data source: https://stats.oecd.org/Index.aspx?DataSetCode=QNA

Figure 3: Consumer price inflation, quarterly 2014-2018, rate of change (%) of CPI over same quarter previous year, 10 countries



Data source: http://www.oecd.org/sdd/oecdmaineconomicindicatorsmei.htm

In order to test rigorously for the determinants of the number of performances per opera houses, we have to adopt a formal model. The available data suggests a dynamic panel data model for the number of performances per opera house depending on GDP growth and unexpected inflation (UNINF): :

$$\log(NUMPE_{i,t}) = \text{a} + b\sum_{h=1}^{4} GGDP_{i,t-h}/4 + c\sum_{h=1}^{4} UNINF_{i,t-h}/4 + \gamma_i + \delta_t + \varepsilon_{it} \qquad (1)$$

Firstly, we take logs of the number of performances per opera house in line with the explanatory variables, which are rates of change and therefore approximately first differences of logs. Secondly, we allow for lags as it takes time to adjust performances to changed macroeconomic conditions. Lags are statistically significant up to length 4 and the equal weight lag distribution is not rejected by the data. Thirdly, UNINF is calculated by estimating a panel AR(1) model with fixed country effects for inflation. This model fits inflation well, and the residuals of this this

model are used then as proxies for unexpected inflation[3]. Fourthly, we allow for so-called country- and time- specific fixed effects $\gamma_i \; and \; \delta_t$, which allow the average number of performances in a country or a quarter to vary systematically across countries and periods.

This model is now estimated with panel methods: if the period fixed effects are statistically significant and uncorrelated with the regressors we provide random period effects estimates which are asymptotically efficient.

Table 1 contains the result we get for the panel regression model (1) with our sample of 200 observations. Firstly, we note that country and period fixed effects are highly significant and that the Hausman test results indicate that the period effects do not correlate with regressors allowing random effect estimation. Therefore, we chose a mixed model with fixed country and random period effects. Secondly, our findings are in line with our a priori expectations as discussed above. We see that the growth rate has a statistically significant positive effect with a coefficient of 0.0253. This means that an increase in GDP growth of one percent leads to an increase in the log of the number of performances of 0.0253, which is approximately 2.5 percent. The impact of the unexpected inflation rate is strong and highly significantly negative: a one percent increase in unexpected inflation leads to an approximate 7.8 percent decrease in the number of performances per opera house. This very strong impact points to an important effect of unexpected changes in inflation on the opportunities of opera houses.

The country fixed effect estimates reported point to great heterogeneity between the countries. The coefficient reported shows the shift in the common intercept by country. The last column of the table shows antilogs in order to see the different number of performances the country fixed effects imply. The table says that holding all else equal Austrian opera houses have four times as many opera performances as the average of all countries. The other extreme is the US, whose have opera companies appearing with only roughly 10 percent of the average number of performances. In general, we see the pattern of a dominant “repertoire” system (AT, CH, CZ, PL,,RU) and “stagione” operation (FR, IT).

[3] The AR(1) coefficient estimate is 0.9 pointing to a strongly persistent inflation process and the R^2 of this regression is 0.912.

Figure 4 plots the period random-effect estimates. This shows the change over time in the number of performances, which is common to all 10 countries and independent of growth and inflation. As we used the log transformation for the endogenous variables, the values are approximately equivalent to percentages, for instance 0.04 is very close to 4 percent. We see a negative trend in the number of performances, which may be interpreted as a general fall in public's interest in opera performances in the 10 countries considered. Another reason could be a trend reduction of subsidies in all these countries.

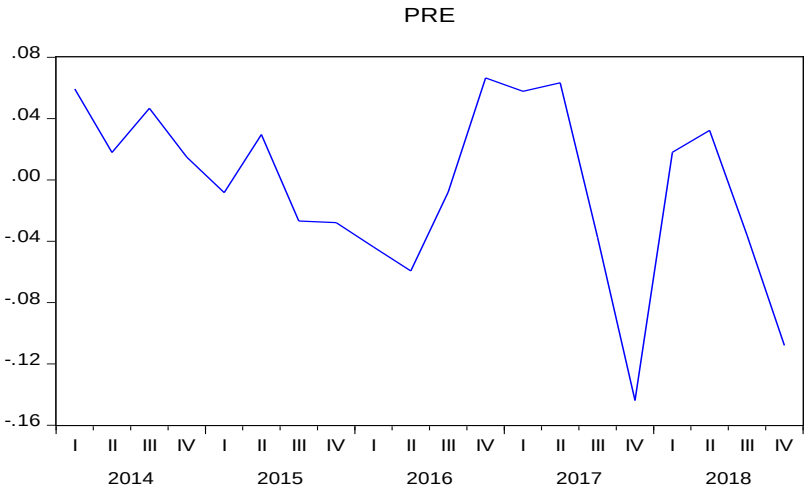
Table 1: Number of performances per opera house, growth and inflation, quarterly random period panel model estimate, 2014-18

country effect F-statistics	Time effect F-statistic	Hausman test (period)	a	b	c
483.35***	3.144***	2.327	-0.6322*** (0.0217)	0.02534** (0.01010)	-0.07813*** (0.01813)
Adj. R-squared	0.9921				
DW	1.374				

Note: standard error in parentheses; *,**,*** indicates significance at the 5 percent, 1 percent and 0.1 percent level, respectively

Country	fixed effects estimates γ_i	Exp(γ_i)
AT	1.428788	4.173638
CH	1.040032	2.829308
CZ	0.951421	2.589387
DE	-0.905950	0.404158
FR	-0.882060	0.413929
IT	-0.625966	0.534745
PL	0.810696	2.249473
RU	0.175146	1.191420
UK	0.407680	1.503326
US	-2.399787	0.090737

Figure 4: Period random effects estimates, number of performances per opera house, 2014Q1-2018/Q4



4. Composer's share in the number of performances

In this section, we will highlight the role of different composers in the scheduling of opera houses. In our sample, we have three dominant composers: Verdi is clearly the leader with an average share of 13 percent in all performances, followed closely by Mozart and Puccini with shares of roughly 10 percent. Four composers with substantially lower mean shares, namely Rossini (4.9%), Donizetti (3.9%), Bizet (3.0%) and Wagner (2.5%), follow them; they in turn keep a sizeable distance to Tchaikovsky, J. Strauss, R. Strauss and Offenbach with mean shares varying between 1 and 1.5%.

Given this difference in importance of different composers for the performance practice of opera houses, we will first show detailed results for the "leading three" and then briefly present the most important results for the remaining group of four composers.

We estimated equation (2) replacing the dependent variable "log number of performances per opera house" with a composer's share in the total number of performances in a country. Table 2, 3 and 4 contain the results for Verdi, Puccini and Mozart, respectively. We see that in all three cases country fixed effects are statistically significant. Weaker evidence of time effects exists for Verdi and Mozart, whereas it is virtually absent for Puccini. In the two former cases, the period

effects are estimated with the random effect model in accordance with the Hausman test results. Interestingly, we find no statistically and economically significant impact of GDP growth and change in inflation on the composer shares. Hence, macroeconomic conditions play only a role for the aggregate number of performances, but have no effect on composer's share. In short, the more interesting results pertain to the variation in mean composers' shares across countries.

Starting with these fixed effects for Verdi, we see a considerable cross-country variation in these estimates. For Italy the intercept, which is very close to the average share in the sample, rises from 13% to nearly 23%, whereas it is reduced to approximately 8% in Austria. Verdi is under-represented in Switzerland, France and the US, whereas his share in the Czech Republic and Poland is rather large, namely close to 17%. The high share in Italy can be interpreted as evidence for a home bias with regard to composers performed in opera houses. The result for the Czech Republic and Poland suggests an interesting historical explanation: Verdi is the composer of the Italian unification process in the middle of the 19th century, which was opposed by the Austrians defending their possessions in Northern and Central Italy in a war. Czechs and Poles also were fully or partly reigned by the Austrian part of the Danube monarchy up to the First World War and had to establish their independence against the Austrians in 1918.

The random period effects for Verdi shows a seasonal high in the third quarter, which is probably caused by the prominence of Verdi operas in the summer festivals.

The results provided by Table 3 for Puccini show some similarities with those for Verdi: we see a clear "home bias" (+5.7 for Italy) and an under-representation in Austria, Switzerland, Germany and France. UK and US opera visitors seem to like the Puccini sound very much, they both have a high share of around 13% and 15%, respectively. The high US share may be also caused by the "verismo" characteristic of Puccini operas often dealing with "ordinary" people and not with noble people and rulers.

The findings for Mozart in Table 4 show weaker country effects than for the two leading Italian composers. Interestingly, we find no significant "home bias" for Austria and the largest average share of 14% is found in Poland, whereas Mozart is under-represented in Italy and Russia. The random period effect estimates mainly reflect "Mozart Hype" in the third quarter of 2015.

Table 2: Share of Verdi operas (percent), growth and inflation, quarterly random period panel model estimates, 2014-18

country effect F-statistics	Time effect F-statistic	Hausman test (period)	A	b	c
10.699***	1.771*	0.5202	13.433*** (1.350)	-0.1591 (0.6183)	-0.2326 (0.928)
Adj. R-squared	0.3851				
DW	2.1832				

Note: standard error in parentheses; *,**,*** indicates significance at the 5 percent, 1 percent and 0.1 percent level, respectively

Country	fixed effects estimates γ_i
AT	-5.222179
CH	-2.572006
CZ	3.536161
DE	-3.024284
FR	-3.499737
IT	9.782361
PL	2.894105
RU	1.827844
UK	-0.892506
US	-2.829759

Figure 5: Period random effects estimates, share Verdi operas (%), 2014Q1-2018/Q4

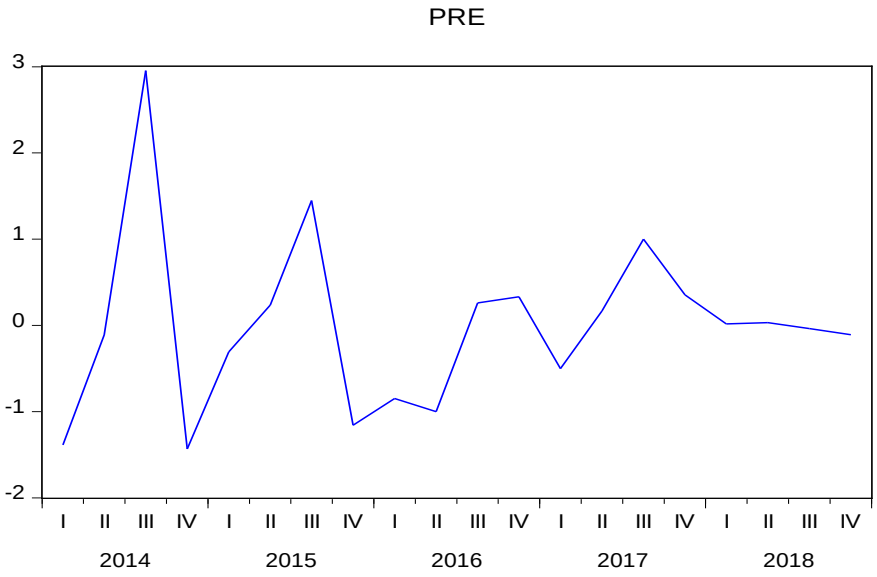


Table 3: Share of Puccini operas (percent), growth and inflation, quarterly

random period panel model estimate

country effect F-statistics	Time effect F-statistic	Hausman test (period)	A	b	c
11.768***	9.315	-	9.998*** (0.8703)	-0.5479 (0.3890)	-0.8822 (0.6412)
Adj. R-squared	0.4253				
DW	2.7178				

Note: standard error in parentheses; *,**,*** indicates significance at the 5 percent, 1 percent and 0.1 percent level, respectively

Country	fixed effects estimates γ_i
AT	-3.691272
CH	-3.743156
CZ	-0.129279
DE	-2.388697
FR	-4.341565
IT	5.714670
PL	2.356460
RU	-1.363158
UK	2.894163
US	4.691833

Table 4: Share of Mozart operas (percent), growth and inflation, quarterly

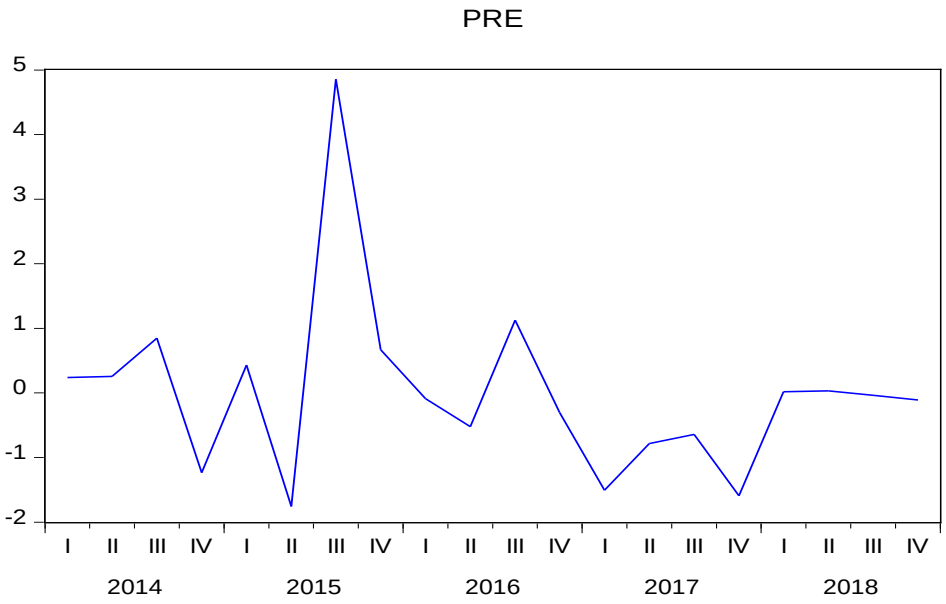
random period panel model estimate

country effect F-statistics	Time effect F-statistic	Hausman test (period)	A	b	c
2.152*	2.746**	2.878	9.928*** (0.6510)	0.0641 (0.2543)	-0.0807 (0.4742)
Adj. R-squared	0.1532				
DW	2.383				

Note: standard error in parentheses; *,**,*** indicates significance at the 5 percent, 1 percent and 0.1 percent level, respectively.

Country	fixed effects estimates γ_i
AT	-0.557468
CH	2.243490
CZ	-2.088599
DE	0.156312
FR	1.058585
IT	-1.918360
PL	3.673409
RU	-1.644826
UK	0.079766
US	-1.002308

Figure 6: Period random effects estimates, share Mozart operas (%), 2014Q1-2018/Q4



Finally, we briefly want to present the most important results for the remaining group of composers in Table 5. The results are similar to those discussed above for the three leaders: no impact of growth and inflation on their performance share, no period effect with the exception of Wagner. Thus again, the interesting results are the country fixed effects reported below. We see a clear home bias for Rossini, Donizetti and Wagner, who all approximately double their average share in their home country. This is, however, not true for Bizet, who is slightly under-represented in France, but strong in Poland and the Czech Republic. Rossini and Donizetti, the latter to a smaller extent, are under-represented in Austria and Germany. Wagner operas are not prominent in the Czech Republic, Italy and Russia, nor to a lesser extent in Poland. This is not surprising given the association of the Wagner clan with the Third Reich and the very bad experience of these countries with Germany during the period 1933 to 1945.

Table 5: Share of operas (percent) of Rossini, Donizetti Bizet and Wagner, country fixed effects in percent, estimate without period effects (except Wagner, random period effects)

	Rossini	Donizetti	Bizet	Wagner
Intercept a	5.403	3.431	3.723	2.580
AT	-1.717943	-0.423839	-0.820475	0.864524
CH	0.756848	-0.544391	-1.777834	-0.552132
CZ	-0.711141	-0.906078	1.982239	-1.478771
DE	-2.089768	-1.144278	-1.480209	3.248795
FR	-0.021186	-0.191654	-0.712317	0.037097
IT	4.693388	3.451615	-0.531101	-1.398831
PL	-0.345491	-1.349129	3.636043	-0.657284
RU	-0.744880	0.534061	-0.112662	-1.159265
UK	0.451548	-0.139677	-0.784426	1.122956
US	-0.271376	0.713370	0.600740	-0.027089
F-statistic Country FE	3.697***	3.058***	2.428**	4.891***
F-statistic Period FE	1.347	0.753	0.768	2.259*

Note: *,**,*** indicates significance at the 5 percent, 1 percent and 0.1 percent level, respectively.

Our econometric analysis clearly indicates that there is no statistically significant dependence of composer shares on GDP growth and inflation. However, we may note that the estimates of the growth coefficient b are mostly negative, and their sum over all seven composers is -0.986. This finding suggests that higher growth may lead opera houses to produce slightly more operas of less well-known composers.

Period random effects are mostly rather weak and the most interesting aspect of this data are the differences across countries. In order to highlight the country differences, we show the means of composers' share in our sample of 20 quarterly observations for the ten countries. Besides the findings with respect to the country fixed effect we already discussed, we see the dominance of Verdi followed by Puccini and Mozart: in four countries his share is clearly largest (CZ, IT, PL, RU) and in all other countries he is second, sometimes only slightly, behind Mozart (AT, CH, DE, FR) or Puccini (US,UK). In addition, we see that in all countries, the "big three" occupy the first three positions and their joint share varies between 23.5 % (AT) and 45.9 % (IT).

Table 6: Mean Share of operas (percent) of Seven Composers, percent

Country	Verdi	Puccini	Mozart	Rossini	Donizetti	Bizet	Wagner
AT	7.84	5.31	10.32	3.13	3.13	2.62	3.61
CH	10,31	4.91	11.21	5.56	4.04	2.84	2.50
CZ	17.07	8.33	8.87	3.37	3.04	5.02	1.05
DE	10.05	6.78	10.37	2.90	2.46	2.00	5.47
FR	9.17	5.64	10.52	5.44	3.40	2.39	2.40
IT	21.90	16.10	7.91	9.88	6.72	3.15	1.07
PL	16.49	9.78	14.18	4.14	3.77	6.69	1.76
RU	15.29	8.83	7.78	4.37	3.55	3.31	1.57
UK	12.52	12.59	10.18	5.20	3.85	2.57	2.96
US	10.50	13.28	9.42	5.05	4.59	4.05	2.19

5. Conclusion

The analysis of quarterly panel of ten countries covering 75 percent of the worldwide opera performances and the years 2014 to 2018 showed that the number of performances per opera house depend positively on growth and negatively on unexpected inflation. In particular the estimated effect of a change in inflation is strong, namely a 1 percent unexpected increase in inflation leads to an approximately 8 percent decrease in the number of performances. In addition, we find highly significant country effects, which corresponds to the differing operational procedures of opera houses, and a time effect indicating a negative trend of the number of performances. By contrast, the shares of the most important composers in the performances, namely Verdi, Puccini, Mozart, Rossini, Donizetti, Bizet and Wagner, seem to be rather stable: there is no significant dependence on growth and inflation, and only very weak time effects exist. However, we find strong cross-country differences in the composers' shares with mostly a home bias except for Mozart and, in particular, Bizet. Some of the cross-country patterns confirm with historical experience of countries like the preference for the "risorgimento" composer Verdi in the Czech Republic and Poland.

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