Fiscal Archetypes in the European Union

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Abstract: A novel statistical approach is used to discern main types of public finance management (or fiscal archetypes) among countries in the European Union. Data, spanning 2002 to 2014, reveals four main archetypes across the dimensions of fiscal policy. Two of them are fiscally sustainable – one comprises big but responsible spenders, and the other – lean governments. Two of the archetypes are not sustainable, with expenditures exceeding revenue. Fiscal archetypes can be fruitfully used to prescribe tailored public policy interventions for countries, taking into account their specific economic and institutional circumstances and thus increasing the efficiency of policy.

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I.   Introduction

Public policy can rarely depend on randomized experiments to guide its actions. It is instead often the practice that cases perceived to be similar are treated in a similar manner, irrespective of some possibly unobserved characteristics. Placing countries into neat groups has both important theoretical and practical justifications. On the theoretical side, it is often the case that countries have sets of unique institutional settings and very different inner workings (Hall and Soskice, 2001). Analyzing similar countries together aids our understanding of their commonalities, while the span of different groups demarcates the space of observed institutional configurations.

On the practical side, it is often the case in public finance analysis that countries are bundled together, often for lack of resources for independent monitoring. For example, during the process of EU accession Bulgaria and Romania were grouped, and they still continue to be grouped within the Cooperation and Verification Mechanism (CVM) in the EU. Large investment banks tend to cover whole regions and thus bundle together smaller countries for analytic simplicity, and so do large multinationals when managing their global portfolio in order to reduce complexity. In addition to that, whenever a reform is being made, policy makers often tend to look to similar countries to inform their decisions or to benchmark policy results. The separation of countries into clear-cut groups or archetypes is therefore both theoretically sound, and practically necessary.

This underlines the question of how one defines similar cases. A broad portfolio of methods are widely used, ranging from quantitative grouping like clustering or similarity indices to more qualitative approaches, leveraging expert knowledge. This paper explores the opportunity to use a novel method for the field of public economics in order to discern clear archetypes (ideal types) of public finance management. In short, we ask the question what the different types of fiscal behavior in the European Union are, and what the practical implications are in order to reduce complexity, aid analysis, and provide for more informed benchmarking in the process of formulating public policy. In the data we observe clear division into four different archetypes that can be used toward these ends.

The paper proceeds as follows. Section II presents a short literature overview and motivating studies. Section III presents our model and results. Section IV outlines a few conclusions and their implications for public policy, and Section V concludes.

II.   Literature Review and Methodology

Discerning clear behavioral types in fiscal and public sector governance has had a long and fruitful history across a multidisciplinary range of fields. The idea behind country groupings dates back to work by Shonfield (1965). Over the following decades, it has developed and now finds a very mature and sophisticated explication in the Varieties of Capitalism approach to understanding institutional settings. In Hall and Soskice's (2001) pivotal work, countries were grouped according to what sets of institutional configurations they have as either liberal or coordinated market economies. Those groups (or type of capitalism) follow a very different logic of economic growth and should therefore be separated for analytical purposes. While this classification may not be exhaustive, and indeed some additions are offered (Noelke and Vliegenthart, 2009; Funk, 2010), it provides a comprehensive way of thinking about this issue.

A large strand of literature has grown around this emerging consensus and provided a number of useful insights on the structure and functioning of modern capitalist economies through sets of mutually supporting institutions (Howell, 2003). These theoretical considerations have also led to a spur in empirical research, testing the practical implications of country groupings into the different ideal types. In this vein, Hall and Gingerich (2009) have found large coordination effects between institutions and a highly statistically significant effect on the resulting economic growth. In short, what group a country belongs to has vital implications as to its economic performance.

Another strand of research focuses on the direct effect of the institutional settings upon fiscal and economic outcomes. In this extensive work Niskanen (2005) provides an excellent example of a data-driven approach to this problem, by outlining government archetypes and estimating the associated fiscal aggregates. He constructs an RBC-influenced macro-finance model in order to track the economic outcomes of three different types of government – democratic, autocratic, and optimal. Depending on which groups countries are in, the resulting disposable income is very different, with democracies performing better than

autocracies but still not as good as the optimal government. These results outline the very different economic outcomes stemming from specific policy choices.

A possible extension of this approach would be to use a clustering algorithm which allows us to discern directly from data what the different sets of fiscal behavior are. Such an approach is already relatively popular in public finance studies (Boreiko, 2002; Liu, 2011), and has the significant benefit of building our models bottom up from the empirical regularities we observe, and not have them *a priori* assumed. Such a blend between informing theory and insistence on empirical proof has the potential to synergize current research results.

On the methodological side, clustering algorithms provide the motivating method for this endeavor but can be substituted by newer econometric tools. They essentially depend on finding the best fitting cluster centroid – i.e. on finding the average type which best describes the data at hand (Hastie et al., 2011). It is however sometimes useful to look not at the average observation but at the observation on the extreme – the so-called clear type or archetype to best understand and describe behavior for public policy purposes. Such ideas are already beginning to disseminate and yield interesting research findings (Li et al., 2003; Porzio et al., 2008; Belenzon et al., 2013). The current research paper applies archetypal analysis (Eugster and Leisch, 2009) to identify different types of fiscal management prevalent in the European Union. This is a statistical tool that allows the analyst to discern clear-cut groupings of countries from a large set of data.

III.   Estimation and Results

Archetypal analysis finds the ideal types by doing the following (for more detail see Cutler and Breiman, 1994). For a matrix of multivariate data X of dimension m and n, the algorithm find a matrix Z of k m-dimensional archetypes such that the convex combination of archetypes minimizes the residual sum of squares (Cutler and Breiman, 1994), or:

$$RSS = \|X - \alpha Z^T\|_2.$$

Here, α denotes the coefficient of the archetypes, which should be greater than zero and sum to one. We can essentially think of those as weighting factors. The archetypes themselves Z, are convex combinations of the data points, such that:

$$Z = X^T \beta.$$

With *β* we denote coefficients on the data set and they are again greater than zero and sum to one. The algorithm proceeds in a number of n iterations until the predefined number of archetypes k is calculated n times, so that stability of the result is achieved.

For the purposes of our research we use a large dataset of fiscal aggregates for the full set of countries in the European Union spanning the time from the first quarter of 2002 to the second quarter of 2014 (Q1.2002-Q2.2014) for 23 fiscal aggregates pertaining to tax policy, consumption policy, subsidies, overall level of revenues and expenditures, and debt position. Data is obtained from the European Statistical Service (Eurostat) database. All data is standardized and presented as a share of total output (percentage of GDP). Total observations are over 27,904. We use the expanded dataset to pin down the number of archetypes but for detailed analysis we use a more compact dataset which significantly eases interpretability.

The compact dataset includes nine key fiscal aggregates (Final consumption expenditure, Gross capital formation, Interest payable, Net lending (+) /net borrowing (-), Subsidies payable, Taxes on income receivable, Total general government expenditure, Total general government revenue, VAT receivable). We should note that results do not change significantly whether the whole analysis proceeds on the full or the compact dataset due to the high collinearity between indicators. Summary statistics for the indicators are presented in Table 1.

*Table 1: Summary Statistics of Fiscal Aggregates (as % of GDP), valid cases N=1178*

	Mean	**St. dev.**	**Median**	**Min**	**Max**	**Skew**	**Kurtosis**
Final consumption expenditure	20.3	3.2	20.1	11.5	28.3	0.1	-0.5
Gross capital formation	3.7	1.4	3.7	-2.7	16.5	1.7	9.0
Interest, payable	2.3	1.4	2.1	0.1	11.1	1.2	3.6
Net lending (+) /net borrowing (-)	-3.0	5.3	-2.6	-42.4	12.5	-1.4	7.5
Subsidies, payable	1.3	0.6	1.3	0.0	3.7	0.4	0.3
Taxes on income, receivable	11.2	5.6	9.7	2.8	31.0	1.4	1.8
Total general government expenditure	45.4	7.3	45.5	28.0	86.6	0.2	0.8
Total general government revenue	42.5	7.2	41.6	26.1	60.1	0.3	-0.8
VAT, receivable	7.5	1.3	7.5	2.1	13.3	0.4	1.2

Source: Eurostat, 2014

Table 1 reveals the wide variance of key fiscal aggregates in the European Union over the period under scrutiny. European governments have been anywhere from extremely austere to very generous. Net borrowing has gone down to 42% of GDP, and net lending has been up to almost 13% of output. Final consumption has been sizable but within large bounds, and capital formation – very unstable. The size of government varies significantly across observations – smallest governments take up as little as 28% of GDP, whereas the largest one – up to almost 87%. The wide standard deviations across all aggregates point at the fact that there is significant dispersion among European countries and it might be analytically useful to discern clear-cut archetypes across such large variations.

The first stage of running the archetypal analysis is to define the correct number of archetypes that are present in the data. The most intuitive way to do this is to see at what number of archetypes the residual sum of squares stops decreasing. Figure 1 presents the scree plots for both the full and the compact datasets. Based on visuals inspection it seems that there are four distinct archetypes of fiscal management in the European Union for the period under scrutiny.

Figure 1: Plots of the Residual Sum of Squares per number of archetypes
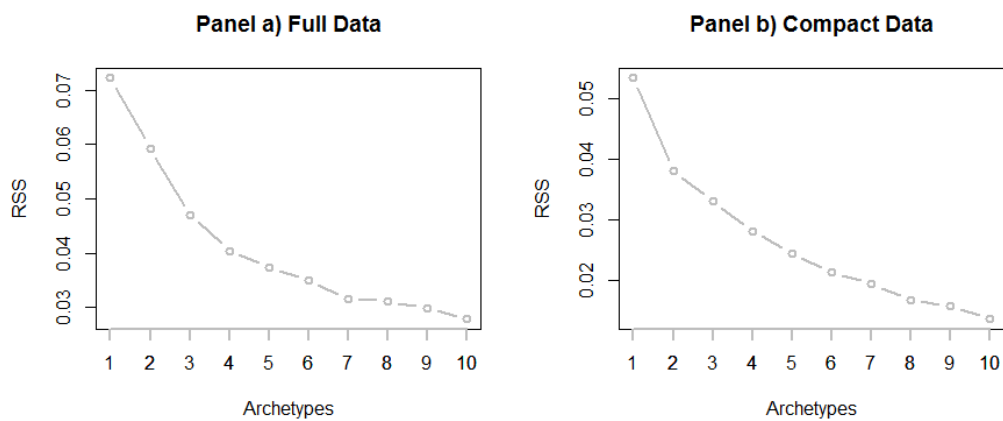
Panel a) of Figure 1 shows the steepest decline of RSS at four archetypes. While not so clearly cut, panel b) also points that the number of archetypes should not be more than four to six. At this limit we begin to notice very slight improvements in fit as we increase the number or archetypes – i.e. the models gain very little in information and interpretability as the number increases. To maintain parsimony and interpretability, therefore, we opt for the algorithm with $k = 4$. The results indeed display four very distinct types of fiscal behavior.

Their parameters are presented in Table 2. Here we should note that a given archetype is not necessarily an observed point – it is rather the edge of the data distribution with archetype parameters calculated by the given algorithm.

Table 2: Fiscal Archetypes in the European Union

Indicator	Archetype 1	Archetype 2	Archetype 3	Archetype 4
Final consumption expenditure	25.69	14.35	20.85	19.52
Gross capital formation	2.94	3.42	9.71	1.18
Interest, payable	2.43	0.60	1.29	5.64
Net lending (+) /net borrowing (-)	2.12	5.34	-17.87	-9.24
Subsidies, payable	2.14	1.02	1.45	0.47
Taxes on income, receivable	24.34	8.05	5.70	7.94
Total general government expenditure	55.66	30.93	54.86	46.86
Total general government revenue	57.78	36.29	36.98	37.64
VAT, receivable	8.90	7.84	7.58	6.04

Archetype 1 corresponds to large governments both in terms of revenue and in terms of expenditure. Their budgets tend to be in surplus (net lenders) with relatively little resource used to pay off old debt – payable interest stands at about 2.4% of GDP. Capital formation is above average but these governments are really distinguished by large consumption expenditure, financed by lavish income taxes. Subsidies are double that of other archetypes. In short, Archetype 1 comprises responsible big spenders with large redistribution and public goods provision. Nordic countries are examples of this case.

Archetype 2 includes much smaller governments as proportion of their total economy. They focus more on capital formation and less on public goods provision, with little taste for paying subsidies (lowest at 0.60% of GDP). Revenues tend to be above expenditures with a small part of revenue going to pay off old debts. These governments tend to be net lenders and finance themselves equally by taxes on consumption and on income. In short, those would be governments with a marked taste for more conservative right-wing policies. The United Kingdom and Germany in some cases resemble this archetype.

Archetype 3 would be governments in dire conditions – expenditure is much larger than revenue and a sizeable part of income goes off to paying old debts. These governments spend heavily on public goods and capital formation, likely in an attempt to offset unfavorable economic winds through management of aggregate demand. In those cases subsidies are relatively high. The tax base is shrinking with the income and consumption taxes brining in

little revenue which necessitates large borrowing. This behavior corresponds to the EU governments during the crisis who try to act counter-cyclically at the price of debt accumulation. For example, France corresponds to this case.

Archetype 4 includes debt-ridden governments during the downward slope of the economic cycle. Interest payments on debt are by far largest (standing at about 5.64% of GDP), while both taxes on income and particularly consumption are insufficient. This results in much larger government expenditure than revenue. While this is true, public goods provision in terms of final government consumption remains at a high point, compensated by insufficient capital formation. In short, this archetype corresponds to debt-ridden countries in the EU with unsustainable public finances that are possibly in need of external assistance. The nations of Southern Europe – Greece, Portugal, Spain, and Italy – during the crisis most closely resemble this case.

Figure 2: Archetype parameters as percentiles of observed distributions
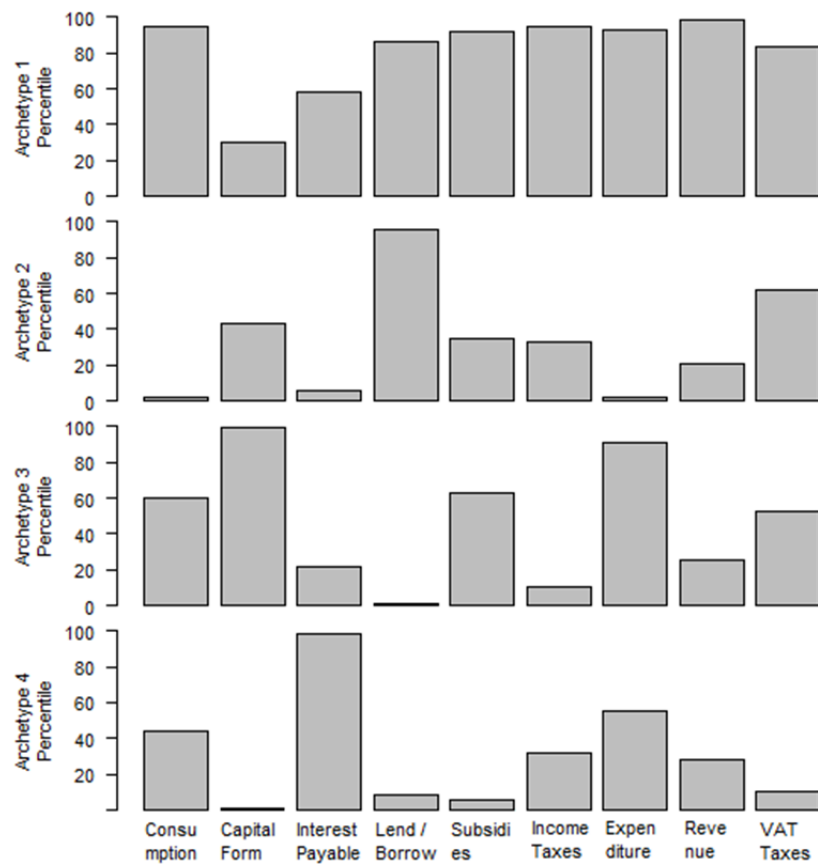
An alternative way to look at those archetypes is to look at where they stand relative to the overall distribution of data. Figure 2 plots the nine fiscal aggregates for the four archetypes compared to all the data points. For example, Consumption expenditure for Archetype 1 governments is in the 95th percentile of the distribution, meaning that Archetype 1 governments are among the top 5% consumers across all observations. In contrast, Archetype 2 governments are in the lowest decile in terms of consumption expenditure. Overall, we can see Archetype 1 as more lavish, and Archetype 2 – as more austere governments. Both archetypes are sustainable as they form primary surpluses which allow the service of debt.

Archetypes 3 and 4 are not sustainable – their fiscal position is deteriorating given the excess of expenditure over revenue. While the imbalances are already visible in Archetype 3, these are particularly pronounced in the case of Archetype 4 governments. In this case interest payable is a large fraction of total output with high expenditure, mainly composed of consumption and very little capital formation.

We can view the archetypal approach as a complement to the Varieties of Capitalism (VoC) literature. While the VoC starts from understanding the internal logic of different capitalist systems, the archetypal analysis presents an entirely data-driven approach to discerning the "varieties" from key economic variables. Both approaches can yield useful insights, and we expect their main conclusions to converge as they grow in sophistication.

IV.   Analysis and Public Policy Implications

Using this algorithm we can classify countries' fiscal behavior as belonging to one of the four archetypes. The fiscal policies as practiced in the second quarter of 2014 are used to discern among the archetypes. Results are presented in Table 3. While countries may exhibit characteristics from different archetypes, there are dominant fiscal management traits that weight largely towards one of the archetypes. Particular care should be taken with countries leaning towards Archetype 4. In Q2 2014 these are Greece, Hungary, Ireland, Malta, Poland, Portugal, Spain, and the United Kingdom. Archetype 4 is distinguished by lack of fiscal sustainability and should be considered particularly risky by both public policy makers and private investors.

Table 3: Classification of country policy in Q2 2014 according to fiscal archetypes

Country	Archetype 1	Archetype 2	Archetype 3	Archetype 4	Classification
Austria	45%	21%	5%	29%	1
Belgium	86%	0%	0%	14%	1
Bulgaria	13%	73%	14%	0%	2
Croatia	45%	23%	26%	6%	1
Czech Republic	28%	54%	17%	1%	2
Denmark	100%	0%	0%	0%	1
Finland	82%	7%	12%	0%	1
France	64%	0%	23%	13%	1
Germany	28%	46%	0	26%	2
Greece	19%	19%	0%	62%	4
Hungary	31%	14%	22%	34%	4
Ireland	0%	32%	0%	68%	4
Latvia	9%	74%	0%	17%	2
Lithuania	0%	62%	4%	34%	2
Luxembourg	36%	64%	0%	0%	2
Malta	25%	28%	10%	37%	4
Netherlands	43%	9%	23%	25%	1
Poland	2%	47%	15%	37%	4
Portugal	18%	4%	3%	75%	4
Romania	0%	71%	0%	29%	2
Slovenia	12%	26%	39%	23%	3
Spain	0%	13%	16%	70%	4
Sweden	72%	10%	18%	0%	1
United Kingdom	5%	24%	9%	61%	4

Source: Eurostat, 2014. Countries with insufficient data availability are excluded.

The archetypal division serves a number of important purposes. Firstly, it allows the student of public finance to analytically discern different fiscal strategies in the European Union based on empirically observed data. This analysis builds the types of behavior from observable aggregates, and groups different governments along those dimensions, which can significantly aid our understanding of choices and strategies pursued by incumbents. The analysis need not be limited to the European Union alone and can be used by a wide variety of actors for any group of countries or regions.

Secondly, archetypal analysis allows for the segmentation of governments which allows more targeted strategies across them. It is very likely that particular policies will be beneficial for some archetypes, but disastrous for others. For example, while fiscal austerity is a must for Archetype 4, it is superfluous, and possible detrimental, for Archetype 1. Archetypal analysis,

therefore, can put an effective end to uniform policy across all the countries and allow for more targeted interventions which are tailored to specific circumstances. Such segmentation is very much akin to the one used in marketing which allows a firm to offer the best set of services to different market segments. There is also the distinct possibility to change policy approach as a country moves from one given archetype to another. Thirdly, the archetypal division can be used by international and supranational organizations in their interaction with different governments. For example, the European Union might want to bundle similar countries during the accession negotiation process or during post-accession monitoring. In the same vein, a development organization may offer one package of assistance to countries of one archetype and a very different one to countries of another, depending on current needs.

Finally, such division is also useful for private sector decision-making. Multinationals will wish to enter new markets that are similar to those where they have historically been successful and avoid those in which they were not. In that respect, this approach is similar to clustering algorithms but has the distinctive advantage of outlining the ideal types, giving the optimal limit cases (or benchmarks) for business decisions. The benefits of enhanced interpretability and easier inclusion in the strategic processes make archetypal analysis a natural winner in such situations.

It is worth noting here that the fiscal archetypes we identified and a given country's classification as belonging to one of them might also be interpreted as symptoms of the deep underlying institutional structure[2]. Thus it is likely that given sets of institutions produce a set of fiscal outcomes (or archetypes). For example, the combination of a large welfare state, strong coordination between the public and the private sectors, rigorous labor relations and a more conservative corporate governance will tend to produce responsible but large governments as is the case in Northern Europe. This neatly corresponds to Archetype 1 countries we already identified.

V.   Conclusion

Countries have distinct sets of mutually supportive institutions that tend to predictably produce patterns of economic and fiscal behavior. This point is made explicit both within the

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[2] The author is grateful to an anonymous reviewer for explicating this point.

varieties of capitalism approach (Hall and Soskice, 2001), as well as in more empirical work in macro-finance (Niskanen, 2005). Similar institutional configurations are likely to produce similar outcomes in terms of fiscal aggregates and output growth. This makes it analytically useful to study groups of countries instead of individual ones.

Focusing on clusters of states is also dictated by practical considerations – it diminishes complexity and provides for better benchmarks, thus better informing public policy discussions. This grouping can be effectively achieved by either *a priori* imposing a structure or by utilizing data to perform a theory-informed analysis. The current research has focused on the latter approach by leveraging a novel statistical algorithm to discern different types of fiscal behavior across the countries of the European Union. We use data from Eurostat spanning all member states over the period 2002-2014 and investigate the dynamics of key fiscal aggregates over this period using archetypal analysis.

Data reveals four distinct archetypes, ranging from responsible big spenders, through lean administrations, and to fiscally unsustainable debt-ridden governments. The fiscal behavior across these groups is widely divergent and we hypothesize that this might be symptomatic for the particularities of the underlying institutional structure. The analysis enables us to classify European Union member states as belonging to one of the archetypes as of Q2.2014, but also allows for dynamic changes in classification as circumstances change.

Discerning the different fiscal management archetypes can be used for a wide variety of purposes but most notably it can be utilized to devise tailored policies for a given country at a given point of time, thus increasing efficiency. Additionally, this approach can be useful for external parties in contact with large number of countries, like international organizations or multinational corporations. Outlining fiscal archetypes can indeed deepen our knowledge of how governments act and allow us to recommend and implement country-specific and conditions-specific policies to achieve notable improvement in general welfare.

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