DOCUMENTOS DE TRABAJO

Pension Funds and the Yield Curve: The Role of Preference for Maturity

Rodrigo Alfaro
Mauricio Calani

N° 821 Junio 2018

BANCO CENTRAL DE CHILE

BANCO CENTRAL DE CHILE

CENTRAL BANK OF CHILE

Documentos de Trabajo del Banco Central de Chile
Working Papers of the Central Bank of Chile
Agustinas 1180, Santiago, Chile
Teléfono: (56-2) 3882475; Fax: (56-2) 3882231

Documento de Trabajo
N° 821

Working Paper
N° 821

Pension Funds and the Yield Curve: the role of Preference for Maturity*

Rodrigo Alfaro
Banco Central de Chile

Mauricio Calani
Banco Central de Chile

Abstract

What is the effect on the yield curve of an increase in market participation of a large institutional investor? To answer this question, we introduce a simplification of the model with heterogeneity of preference for maturity first proposed by Vayanos and Vila (2009). We show that our simplification entails little loss in fit and interpretation, while it provides greater simplicity and tractability. We take Chilean data of the sovereign fixed income market, and conclude that; for an additional one percent of higher market share of Pension Funds Administrators in said market, interest rates of the 10-year (5-year) associated instruments, are reduced by 6bp (4bp).

Resumen

¿Cuál es el efecto en la estructura de tasas de mayor participación de mercado de un inversionista institucional grande? Para responder esta pregunta introducimos una simplificación al modelo con inversionistas con preferencias heterogéneas por madurez, propuesto inicialmente por Vayanos y Vila (2009). Mostramos que nuestra simplificación implica poca pérdida en ajuste a los datos, y en interpretación; mientras que es bastante más simple y replicable. Usando datos chilenos del mercado de renta fija soberano en UF, concluimos que cada uno por ciento de mayor participación de mercado de las Administradoras de Fondos de Pensiones, está asociado a una reducción en las tasas de interés de los mismos instrumentos de 4pb y 6pb, para papeles de 5 y 10 años de madurez residual, respectivamente.

* We thank Claudio Raddatz, for his comments to a previous version of the document, as well as an anonymous referee. The opinions expressed in this article are the authors' own and do not necessarily represent the views of the Central Bank of Chile or its Board Members. Emails: ralfaro@bcentral.cl, mcalani@bcentral.cl.

I. Introduction

Pension Fund Administrators (PFAs) are important participants in the Chilean fixed income market, both in nominal and inflation-indexed instruments. In particular, as of October 2017, they held over 70% of the total stock of sovereign bonds denominated in the inflation index called "Unidad de Fomento (UF, i.e., "Development Units")"[1]. Due to the nature of their business, these agents have a preference for buying and maintaining these types of bonds, especially with longer maturities. Thus, it is worth asking if this preference for maturity has any effect on long-term rates.

In this paper we seek to answer this question using a related model of yield curve that incorporates preferences for maturity. In particular, we use a reduced version of the Vayanos and Vila model (2009); they postulate that observed structure of interest rates in the sovereign bond market is the result of the interaction of two types of agents: (i) investors, who have explicit preferences for a certain maturity in financial instruments, and (ii)) arbitrators, who buy and sell instruments along the yield curve in search for return, and who, being risk averse, must be compensated for the risk derived from their arbitrage. Although this model is of medium-large scale and its solution is highly non-linear in the parameters, Vayanos-Vila conclude that the structure of interest rates has a functional form in the affine family of yield curve models. Considering this last point, we estimate a standard affine model equivalent to the reduced form of Vayanos-Vila. To evaluate the quality of this strategy, we evaluated our simplification for the US case, and compared our results with Kaminska and Zinna (2014) who utilized the full Vayanos-Vila model to assess the effect of QE and foreign demand on the US yield curve. We note from this comparison that our standard affine model

[1] According to data from "Depósito Central de Valores".

appropriately captures the dynamics of the factors of interest. We build on this success to apply the affine model to the Chilean fixed income market in UF and extract a latent factor, which captures the preference for maturity.

With the estimate available for the case of Chile, we show that the dynamics of the latent factor related to the preference for maturity is highly correlated with the market share of Pension Funds. This relevant result enables us to establish a quantitative measurement of the impact of the market share of these institutional investors on the yield curve of inflation indexed interest rates. In particular, using our model, we estimate that the PFA's increase in their market share, in the 5-year period from June 2011 to June 2016 (52 to 67%), can explain 90 (60) basis points of the reduction observed for the 10-year (5-year) interest rate during said period.

II. Analytic Framework

In this section we discuss the interest rate model, proposed by Vayanos and Vila (2009), which introduces a type of agent that has a preference for a particular maturity. We say this agent has a "preferred habitat". We also discuss the relationship between a reduced functional form obtained from the full Vayanos-Vila model, and those obtained from a (related) dynamic factors model. Finally, we show that with the related model, it is possible to collect the dynamics reported by Kaminska and Zinna (2014), who estimate the Vayanos-Vila model for the US indexed bond market.

1. Preferred Habitat

The Vayanos-Vila model assumes that there are two types of agents. First are the agents who have a marked preference for a certain maturity because of the nature of their business, whom we call investors or customers. Second are the arbitrators who have no preferences for any maturity, but who buy and sell bonds at any time to satisfy their search-for-return motive. These last agents are risk averse, hence their intermediation requires compensation. The co-existence of both types of agents is important for a reasonable yield curve, in the presence of preferences for maturity. For instance, if investors with a preference for maturity were the only participants in the market, then the yield curve would be extremely segmented. The optimizing behavior of the arbitrators guarantees that bonds with very similar maturity also have very similar prices[2].

Additionally, Vayanos and Vila assume two dynamic risk factors. The first factor captures the short-term rate (r_t), and the second factor corresponds to a factor demand for bonds of a specific maturity (d_t). Arbitrators have an investment strategy that maximizes the return and minimizes the variance of the portfolio subject to (i) the law of motion for the value of the portfolio that considers purchases, sales, and price changes, and (ii) spot rates that are linear in the factors r_t and d_t .The most important result of the Vayanos-Vila model is the functional form of the solution for the rate of return in t of a bond of maturity n. In particular, the authors conclude that this is linear in the two factors mentioned above. Let us call z_{nt} the interest rate of a bond with maturity n observed in t. Then, its relation to the factors is as follows:

$$z_{nt} = A + B(n)\frac{r_t}{n} + C(n)\frac{d_t}{n} + \sigma_e e_{nt}\,. \tag{1}$$

[2] Kohn (2016) proposes an alternative model to generate a relationship between institutional (or foreign) demand and lower levels of interest rates. This model builds on the implications of an asset pricing model based on consumption with habit in the latter, where greater demand for long-term instruments affects the term premium. All in all, this type of model also needs to assume the dynamics of demand for bonds with longer maturities, so the specification in (1) is also consistent with such a type of model.

Where e_{nt} is measurement error, iid standarized, and σ_e its standard deviation.

It should be noted that the coefficients of the reduced model (1) are functions of 10 fundamental parameters; in particular: (i) the persistencies, unconditional means, and volatilities of the model factors (short-term interest rate and demand); (ii) the risk aversion coefficient of the agents who arbitrate; (iii) the demand elasticity of the agents that have preferred habitat; and (iv) a measurement error. However, for our purpose we only need to estimate the coefficients as a whole, and not each parameter of the Vayanos-Vila model separately. Thus, we estimate the equivalent model of two factors, adjusted for risk and with measurement error, totaling 7 identifiable parameters (See Shreve, 2004).

2. Dynamic Nelson-Siegel: an application.

Given the previous discussion, we propose to use the dynamic model of Nelson and Siegel (1987) (hereafter, DNS) to characterize the preferred habitat phenomenon. As is standard in the literature, we will consider the following three fundamental ingredients to solve the DNS model: (i) relationship of the short-term interest rate with non-observable factors; (ii) dynamics of non-observable factors as measured by neutral risk; and (iii) valuation according to martingale or validity of the expectations hypothesis (with appropriate correction by Jensen's term).

Thus, we assume that the short-term interest rate is the sum of a first factor, x_t, plus a constant:

$$z_{1t} = \mu + x_t \tag{2}$$

Additionally there is a second factor, y_t, that impacts the expectations of the short rate in a latent way and that under the neutral risk measure has joint dynamics with the first factor. Such relationship can be expressed through a VAR of order one[3]:

$$\begin{pmatrix} x_t \\ y_t \end{pmatrix} = \begin{pmatrix} \phi & 1-\phi \\ 0 & \phi \end{pmatrix} \begin{pmatrix} x_{t-1} \\ y_{t-1} \end{pmatrix} + \begin{pmatrix} \sigma_u & 0 \\ \rho\sigma_v & \sqrt{1-\rho^2}\sigma_v \end{pmatrix} \begin{pmatrix} u_t \\ v_t \end{pmatrix}, \tag{3}$$

where it is assumed that errors u_t y v_t are iid standard normal. That is, there are two latent factors, which directly and indirectly influence the future dynamics of the short rate. If we iterate (2) forward using the dynamics of the factors and the expectations hypothesis, we can obtain expressions for the long rates as in (1).

Dai and Singleton (2003) point out that a model with normal errors containing K latent factors has a total of $(K+1)(K+2)/2$ identifiable parameters in the neutral risk measure. In our case, this equates to a total of six parameters. However the model (2) - (3) imposes that the eigen values of the VAR are real and repeated, which reduces the identification to five parameters. Considering the above, and that bond prices can be obtained through a martingale, relevant rates for each maturity will be the sum of the expectations component for short-term rates plus a Jensen term that contains the variances of the errors of the model presented in (3). This specification exists because, under the normality of factors, prices of bonds will be log-normal, which in turn implies that there is an exact relationship between the parameters of the model and Jensen's term, thus being invariant over time (Campbell et al., 1997). Hence,

[3] We refer to "neutral risk measure" as that parameterization in the dynamics of the factors that allow us to adjust the observed value of the interest rates through the yield curve. In contrast, the "physical risk measure" corresponds to that parametrization of the dynamics of the factors that produces the best short-term prediction.

the rates adjusted for their historical averages can be expressed linearly in the non-observed factors as follows[4]:

$$\tilde{z}_{nt} = z_{nt} - \alpha_n = \left(\frac{1-\phi^n}{1-\phi} \right) \frac{x_t}{n} + \left(\frac{1-\phi^n}{1-\phi} - n\phi^{n-1} \right) \frac{y_t}{n} . \qquad (4)$$

In (4) we note that the weight associated with the first factor (x_t) decays with maturity, while the weight on the second is equal to zero if $n = 1$ and converges to zero if $n \to \infty$.

By comparing (4) and (1), we conjecture that the first factor captures the short term interest rate, while the second factor represents the factor demand first introduced in the Vayanos-Vila model. From equation (4) we note that ϕ is key in determining the relative importance of both factors. In particular, for a given n^* maturity, there exists a ϕ^* such that the weight of the second factor is maximized exactly at n^*. For instance, if we consider such maximum should be around 10 years (hence, a preferred habitat), then the associated persistence parameter should be approximately 80.7% (refer to Figure 1 for other maturities and the parameter value needed for such maturities to be the preferred habitat).

In the next section, we exploit the relationship between the persistence parameter and the preferred habitat in order to calibrate our model for the US case, and compare our results to

[4] In the literature of dynamic yield curves, there are several parametrizations for the dynamics of factors that enable identification of the same problem. In this case, structure (2) - (3) implies that the parameters associated with the variance will only affect Jensen's terms.

those in Kaminska and Zinna (2014). Additionally, when turning to Chilean data, we estimate the state space model in (3) and (4) using maximum likelihood[5].

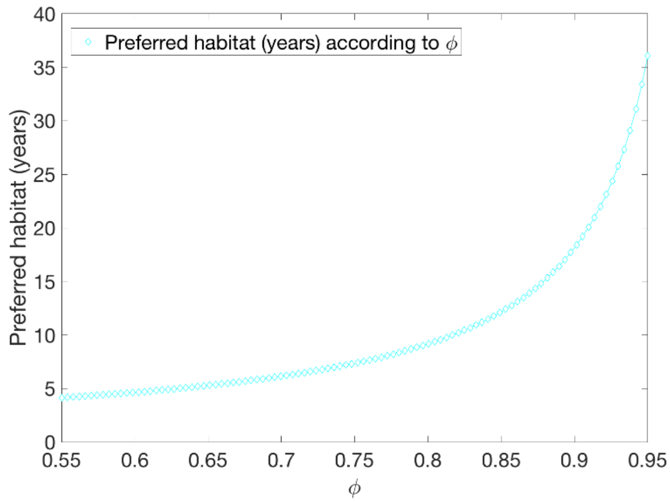


Figure 1: Relation between the persistence parameter ϕ (horizontal axis) and the preferred hábitat maturity (expressed in years, vertical axis). The preferred habitat is calculated at the n which maximizes the weight accompanying factor y_t in equation (4).

III. Empirical implementation

In this section we present the estimates of the DNS model for both the US and Chile. In the first case, we base our calculations on a calibration of the model and bond data since 2004. We show that the DNS model appropriately recovers the dynamics of the factors. In the case of Chile, we estimate the DNS model with maximum likelihood and the Kalman filter in the system of equations (3) - (4) presented in the previous section.

5 Note the model uses the Kalman Filter to filter the factors, and hence includes a measurement error in the signal equation

1. Approximation of the model in Kaminska y Zinna (2014) for the US

Kaminska and Zinna (2014) estimate the Vayanos-Vila model using US indexed bonds with maturities of 2, 3, 4, 5, 7, 10 and 20 years, on a monthly sample that covers the period 2001-2012. Because we use a similar strategy it is important to understand their complete model, which considers a total of 10 parameters, two of which need to be calibrated. Kaminska and Zinna estimated the remaining parameters with Bayesian methods, and using the mean of the posterior distribution, they filter the short-term interest rate and demand factors. Finally, said authors regress this second factor against the purchases of long-term bonds by the Fed, as well as those by foreign investors, both in market shares, to conclude that these purchases had an impact on the 10-year rate of 140 and 80 bp respectively.

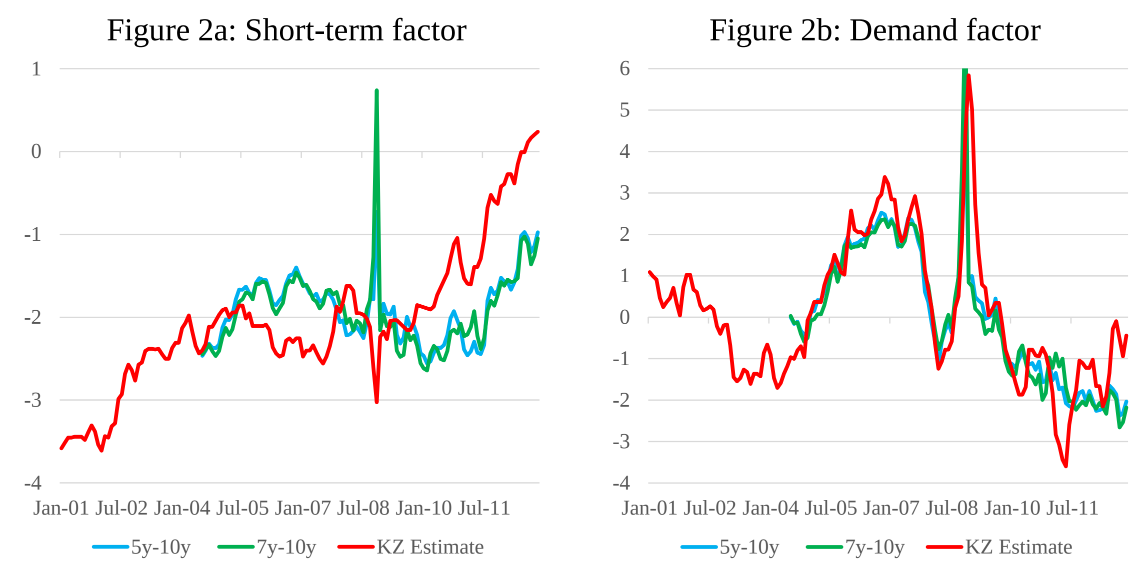


Figura 2: Comparison of results in Kaminska and Zinna (2014) (shown by the red line) with the DNS model calibrated for preferred hábitat at 8.5 years maturity.
Note: Blue and Green lines represent the short rate/demand factors for the DNS model using monthly data for the indexed rate between 2004 and 2012. The blue line uses data for 5y/10y maturity bonds, and the green line uses bonds with 7 and 10 year maturities.

As mentioned above, the estimation of the DNS model for this case (US data) considers a calibration of the persistence parameter of 0.77, which is consistent with the maximum weight for the demand factor to be equal to 8.5 years, as documented by Kaminska and Zinna (2014)[6]. In our illustration we use the indexed rates of US Treasury bonds of five and seven year maturities, and five and 10 years for the estimation of the factors through equation (4). The simplicity of this approach makes it clear that the functional form of DNS (4) is able to properly accommodate and replicate the result of Kaminska and Zinna (2014), with a brief divergence in the period of the financial crisis (Figure 2). Note that at this point there is no estimation, and in principle the model fit could be improved, but we choose to follow the results in Kaminska and Zinna in order to emphasize the flexibility of equation (4).

There are several dimensions to discuss regarding the replication of these results. First, the original study considers a higher number of interest rate series, which would allow the estimation of the factors to be smoother. Additionally, the sample used in this replica is shorter, starting in 2004, which could reduce the accuracy of the parameter and factor estimates. Finally, the model used for replication contains considerably fewer parameters, reducing in part its flexibility, which is reflected in the factor weights (Figure 3). In effect, the calibration of the parameters aims to replicate the preferred habitat, so the weight associated with the demand (yellow line) closely follows that of Kaminska and Zinna, while the factor associated with the short rate differs substantially, losing effectiveness in said dimension, which is a direct result of fewer degrees of freedom. Despite the above, the extraction of both factors by the DNS model is remarkably similar to that reported by Kaminska and Zinna (2014) as can be seen from Figure (2). This result leads us to conclude

[6] Figure 1 shows the relationship between the persistence parameter and the maturity in which the demand factor attains its maximum weight.

that equations (3) - (4) do a good job in extracting the described risk factors, and hence present a sensible framework to use in our application to Chilean data.

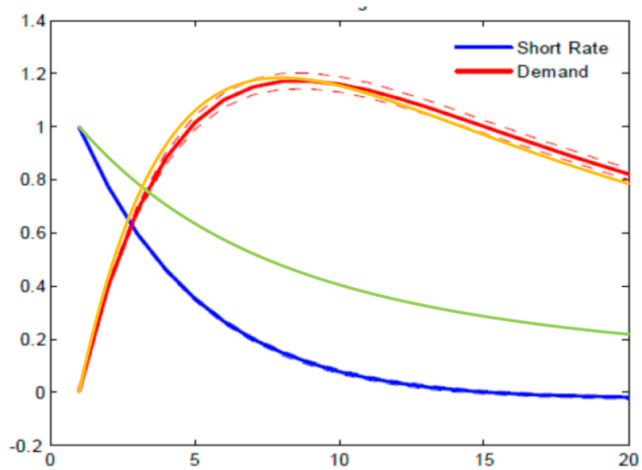


Figure 3: Factor weights (vertical axis) under benchmark calibration according to maturities (horizontal axis). Red and blue lines are associated to the solution by Kaminska and Zinna (2014), and yellow and Green lines use the DNS approximation in equation (4).

2. Application to Chile and the Role of Pension Funds

Chilean Pension Funds (PF) hold 22% of their portfolio, as of August 2017, in fixed income instruments, mostly Central Bank and Treasury bonds, and they represent more than 61% of the total fixed income market and 75% of the funds denominated in UFs. This motivates the use of the previous model to determine the relevance of a possible preferred habitat by these institutions, and with it their impact on the yield curve.

Operationally we consider the state-space model of equations (3) and (4) that we reproduce here for convenience. This model is composed of a signal equation and a bi-varied system that represents the dynamics of the states[7]:

$$\tilde{z}_{nt} = \left(\frac{1-\phi^n}{1-\phi}\right)\frac{x_t}{n} + \left(\frac{1-\phi^n}{1-\phi} - n\phi^{n-1}\right)\frac{y_t}{n} + \varepsilon_{nt}$$

$$\begin{pmatrix} x_t \\ y_t \end{pmatrix} = \begin{pmatrix} \phi & 1-\phi \\ 0 & \phi \end{pmatrix}\begin{pmatrix} x_{t-1} \\ y_{t-1} \end{pmatrix} + \begin{pmatrix} \sigma_u & 0 \\ \rho\sigma_v & \sqrt{1-\rho^2}\sigma_v \end{pmatrix}\begin{pmatrix} u_t \\ v_t \end{pmatrix}.$$

Here $(x_t \ \ y_t)'$ is the state vector which contains our objects of interest: the risk factors associated with the short rate and the preferred habitat. Also, let $\tilde{z}_{nt}$ be the signal corresponding to bond yields in UFs, demeaned by their historical average. Additionally, let us consider a measurement error of the interest rates that we assume is normally distributed with zero mean and variance σ_ε^2 for all maturities. This error is ortogonal to errors u_t and v_t, which in turn we asume are also standard normal. We retrieve our data on inflation indexed interesta rates from the website of the Central Bank of Chile.

Table 1: Maximum likelihood estimation of model in (3)-(4)

Parameter	ϕ	σ_u	σ_v	ρ	σ_ε
Point Estimate	0.8692	0.5164	0.7880	-0.8110	0.0264
Standard Error	0.0038	0.0387	0.0632	0.040	0.0018

[7] At the risk of being redundant, note that we use the terminology used in Diebold, Rudebusch and Aruoba (2006). Here, *state* refers to the latent risk factors, and *signal* to the observed variables on which one imposes some structure: in this case; yields to different maturities. This way we intecheangeably use the term factor and state referring to the same vector $(x_t \ y_t)'$.

As we reviewed in the previous section, since we restrict the transition matrix of states to have equal real roots, the model contains a total of five parameters. The estimation of the states is done using the Kalman Filter, while the estimation of the parameters is done through Maximum Likelihood. Rates denominated in UF are used for 1, 2, 5, 10, 20 and 30 years from June 2008 to June 2016. The estimation of the model accounts for an estimated persistence parameter of $\hat{\phi} = 0.8692$, which implies a preferred habitat of 13.92 years (Figure 1). The model has a sensible goodness of fit with a tight variance for the measurement error (Table 1).

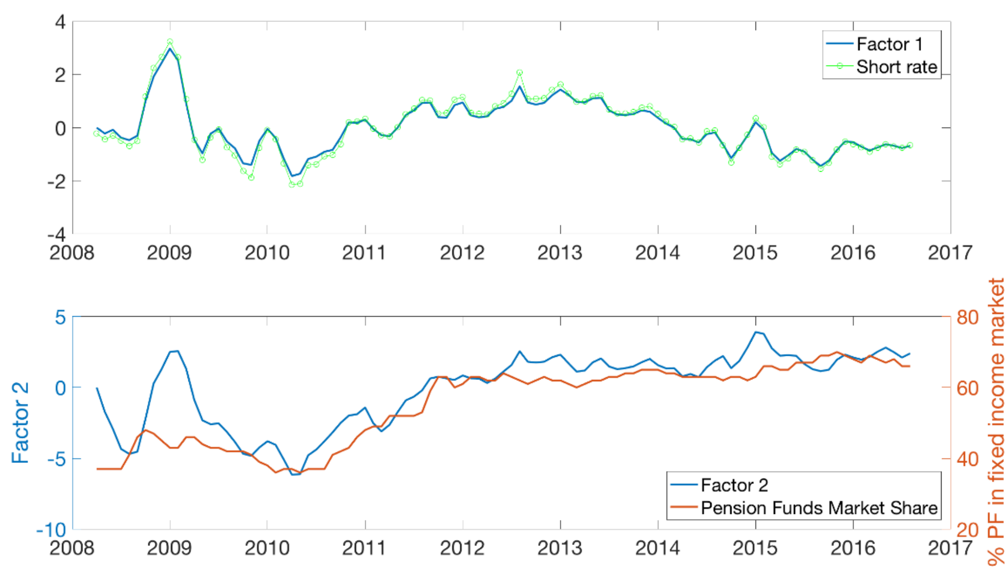


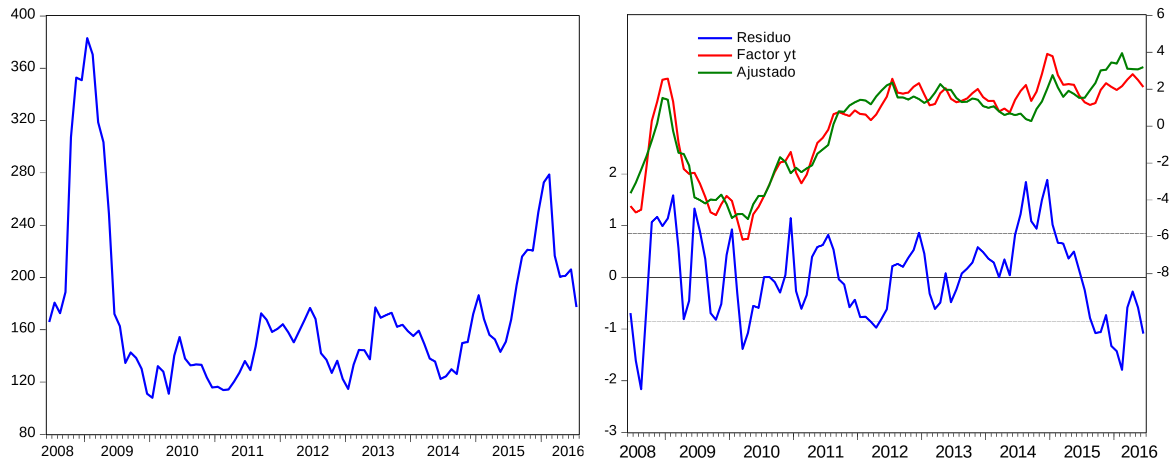
Figura 4: Estimation of DNS factors under máximum likelihood. The above panel shows the short rate factor in blue and the short rate in green. The lower panel shows (on the left axis) the demand factor in blue, and (on the right axis) in orange, the market share of PFA in the indexed sovereign bond market.

Although it is known that the estimation of the state-space models makes it difficult to interpret the factors (Piazzesi, 2010), we note that the first factor closely follows the short-term interest rate (1 year), which is consistent with the Vayanos-Vila model and the empirical results previously obtained for the US (and our conjecture). The second factor, which is understood as a demand factor, closely follows the Pension Funds market share in the fixed income market (Figure 4). Similar to the argument by Kaminska and Zinna (2014), from this factor it is possible to infer the preferences for maturity of certain agents. This observation allows us to argue that, in an affine model with real rates, the second factor (or a third factor in a model with nominal rates) is not simply a statistical adjustment as previously stated in the literature (Diebold, Rudebusch and Aruoba , 2006), but it is related to the preference for maturity by certain agents.

While the estimation of the second factor has a very close correspondence with the participation of PFs in the fixed income market, a brief but relevant divergence is observed in the period 2008-2009. Coincidentally, in the same period the spreads for sovereign bonds of emerging countries appeared to be very dynamic. To analyze this point in more detail, we consider the following (stark) regression,

$$d_t = \beta_0 + \beta_1 Sh_t + \beta_2 EMBI_t + u_t \tag{5}$$

where d_t is the demand factor extracted from our state space model, Sh_t is the market share in the indexed (UF) fixed income market held by PFs, and $EMBI_t$ corresponds to the country risk premium measured by the Emerging Market Bond Index (EMBI) for Chile, and expressed in basis points. Evidently, from the numbers in Table 2 and Figure 5, the adjustment improves, as there is no change in the value, or significance, of the coefficient associated with the participation of the AFPs.



Panel (a): EMBI Chile Panel (b): Regression adjustment

Figure 5: Partial correlation of demand factor with Pension Funds market share in the sovereign indexed fixed income market in and the EMBI Chile index.

Thus, we summarize the main finding of this paper, that the estimated model allows us to quantify the effect of the greater market participation of the PFs in the fixed income market (in UF) in the indexed interest rates. For this purpose, we used the estimate of the previously filtered demand factor and considered the event between June 2011 and June 2016. In this window of five years, Pension Funds increased their market share from 52% to 67%. In light of our estimates, we imply that this increased market participation, tainted with preference for maturity, led to a reduction in the 10 year maturity interest rate of the order of 90 pb, and of 60 bp in the five years maturity interest rate.

Table 2: Partial correlation factor 2 (demand) with participation of the AFPs in thE national fixed income market in UF

	Dependent variable: demand latent factor Sample June 2008 to June 2016, monthly	
Independent Variable		
	(1)	(2)
Pension Funds Market Share (%)	0.21***	0.21***
	(0.01)	(0.01)
EMBI Chile		0.01***
		(0.00)
Constant	-11.56***	-13.65***
	(0.69)	(0.65)
R2	0.76	0.83

IV. Conclusion

This work is motivated by the previous work of de Vayanos and Vila (2009), who developed a yield curve model for asset valuation in which two types of agents co-exist: investors who have preference for a specific maturity, and risk-averse arbitrators, who buy and sell instruments along the yield curve in order to obtain a return. The latter assure that for very similar maturities, the traded prices are also very similar. The main result of Vayanos and Vila (2009) is that although the model is highly non-linear in the fundamental parameters, it is linear in the two incorporated risk factors: short interest rate factor, and demand factor. Given this result, we propose to use and estimate the Nelson-Siegel Dynamic model, with which we successfully replicate the results of Kaminska and Zinna (2014) for the case of the United States. With these results, we estimate the DNS model for the case of Chile, considering interest rates of instruments denominated in “Unidades de Fomento” (UF), an inflation-tied index. Our two findings are: (i) the preferred habitat for the Chilean case is approximately 14 years; and, (ii) the estimated second factor (demand) is highly correlated with the market share of the Pension Funds in such market. Thus, increased participation of these agents in said market would allow, on the basis of the model, to explain part of the lower long-term interest rates observed during June 2011 and June 2016. In this five-year window, Pension Funds increased their market share from 52% to 67%., from which we estimate a resulting reduction in the 10 (5) year maturity interest rate on the order of 90 (60) pb.

References

Campbell, J. Y., Lo, A. W. C., & MacKinlay, A. C. (1997). "The Econometrics of Financial Markets" (Vol. 2, pp. 149-180). Princeton, NJ: Princeton University Press.

Dai, Q., & Singleton, K. (2003). "Term structure dynamics in theory and reality". *Review of Financial Studies*, 16(3), 631-678.

Diebold, F. X., G. D. Rudebusch y S. B. Aruoba (2006), "The Macroeconomy and the Yield Curve: A Dynamic Latent Factor Approach," *Journal of Econometrics* 131, 309-338.

Kaminska, I. y G. Zinna (2014). "Official Demand of U.S. Debt: Implications for U.S. real interest rates." IMF Working Paper WP/14/66.

Kohn, David (2016). "Addicted to Debt: Foreign Purchases of U.S. Treasuries and the Term Premium." Documento de Trabajo No. 480, Instituto de Economía, Universidad Católica de Chile.

Nelson, C. R., & Siegel, A. F. (1987). "Parsimonious Modeling of Yield Curves". *Journal of Business*, 473-489.

Piazzezi, M.. (2010). "Affine Term Structure Models". *Handbook of Financial Econometrics*. Elsevier, 691-766.

Shreve, S. E. (2014). Stochastic calculus for finance II: Continuous-time models (Vol. II). Springer Science & Business Media.

Vayanos, D. y J. Vila (2009). "A Preferred-Habitat Model of the Term Structure of Interest Rates," NBER Working Papers No. 15487, National Bureau of Economic Research.

Documentos de Trabajo **Banco Central de Chile**	**Working Papers** **Central Bank of Chile**
NÚMEROS ANTERIORES	PAST ISSUES
La serie de Documentos de Trabajo en versión PDF puede obtenerse gratis en la dirección electrónica: www.bcentral.cl/esp/estpub/estudios/dtbc. Existe la posibilidad de solicitar una copia impresa con un costo de Ch$500 si es dentro de Chile y US$12 si es fuera de Chile. Las solicitudes se pueden hacer por fax: +56 2 26702231 o a través del correo electrónico: bcch@bcentral.cl.	Working Papers in PDF format can be downloaded free of charge from: www.bcentral.cl/eng/stdpub/studies/workingpaper. Printed versions can be ordered individually for US$12 per copy (for order inside Chile the charge is Ch$500.) Orders can be placed by fax: +56 2 26702231 or by email: bcch@bcentral.cl.

DTBC – 820

Credit Guarantees and New Bank Relationships
William Mullins y Patricio Toro

DTBC – 819

Asymmetric monetary policy responses and the effects of a rise in the inflation target
Benjamín García

DTBC – 818

Medida de Aversión al Riesgo Mediante Volatilidades Implícitas y Realizadas
Nicolás Álvarez, Antonio Fernandois y Andrés Sagner

DTBC – 817

Monetary Policy Effects on the Chilean Stock Market: An Automated Content Approach
Mario González y Raúl Tadle

DTBC – 816

Institutional Quality and Sovereign Flows
David Moreno

DTBC – 815

Desarrollo del Crowdfunding en Chile
Iván Abarca

DTBC – 814

Expectativas Financieras y Tasas Forward en Chile
Rodrigo Alfaro, Antonio Fernandois y Andrés Sagner

DTBC – 813

Identifying Complex Core-Periphery Structures in the Interbank Market
José Gabriel Carreño y Rodrigo Cifuentes

DTBC – 812

Labor Market Flows: Evidence for Chile Using Micro Data from Administrative Tax Records
Elías Albagli, Alejandra Chovar, Emiliano Luttini, Carlos Madeira, Alberto Naudon, Matías Tapia

DTBC – 811

An Overview of Inflation-Targeting Frameworks: Institutional Arrangements, Decision-making, & the Communication of Monetary Policy
Alberto Naudon y Andrés Pérez

DTBC – 810

How do manufacturing exports react to RER and foreign demand? The Chilean case
Jorge Fornero, Miguel Fuentes y Andrés Gatty

DTBC – 809

A Model of Labor Supply, Fixed Costs and Work Schedules
Gonzalo Castex y Evgenia Detcher

DTBC – 808

Dispersed Information and Sovereign Risk Premia
Paula Margaretic y Sebastián Becerra

DTBC – 807

The Implications of Exhaustible Resources and Sectoral Composition for Growth Accounting: An Application to Chile
Claudia De La Huerta y Emiliano Luttini

DTBC – 806

Distribución de Riqueza No Previsional de los Hogares Chilenos
Felipe Martínez y Francisca Uribe

DTBC – 805

Geopolitical Tensions, OPEC News, and Oil Price: A Granger Causality Analysis
Carlos Medel

BANCO CENTRAL
DE CHILE